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Coordination of outer space activities within the United Nations system: programme of work for 2000 and 2001 and future years

Report of the Secretary-General

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Explanatory notes

ACSYS	Arctic Climate System Study
ADS	automatic dependent surveillance
AFRICOVER	Land Cover Map and Geodatabase for Africa (FAO)
AGPP	Plant Protection Service (FAO)
AGRHYMET	Regional Training Centre for Agrometeorology and Operational Hydrology and their Applications
AIT	Asian Institute of Technology
AOC-HYCOS	West and Central African Hydrological Cycle Observing System
APAN	Asia-Pacific Advanced Network
ARTEMIS	Africa Real-Time Environmental Monitoring Information System (FAO)
ASEAN	Association of South-East Asian Nations
AVHRR	advanced very high resolution radiometer
BDT	Telecommunications Development Bureau (ITU)
BR	Radiocommunication Bureau (ITU)
BRGM	Bureau de Recherches Géologiques et Minières
CCEE	CIS, Central and Eastern European countries
CCRS	Canada Centre for Remote Sensing
CDR	Council for Development and Reconstruction (Lebanon)
CEDARE	Centre for Environment and Development for the Arab Region and Europe
CEOS	Committee on Earth Observation Satellites
CEPREDENAC	Centre for Coordination of the Prevention of Natural Disasters in Central America
CEReS	Centre for Environmental Remote Sensing (Japan)
CIAT	International Centre for Tropical Agriculture
CIFEG	International Centre for Training and Exchanges in Geosciences
CILS	CEOS Information Locator System
CIP	Catalogue Interoperatibility Protocol
CIS	Commonwealth of Independent States
CLIPS	Climate Information and Prediction Services (WMO)
CLIVAR	climate variability and predictability
CNES	Centre national d'études spatiales (France)
CNS/ATM	communications, navigation and surveillance and air traffic management
COMEST	World Commission on the Ethics of Scientific Knowledge and Technology
COSPAS-SARSAT	International Satellite Systems for Search and Rescue

DBCP	Data Buoy Cooperation Panel
DCP	data collection platform
DEIA&EW	Division of Environmental Information, Assessment and Early Warning (UNEP)
DUP	Data Users Programme (ESA)
EAP.AP	Environment Assessment Programme for Asia and the Pacific (UNEP)
EARSel	European Association of Remote Sensing Laboratories
ECA	Economic Commission for Africa
ECE	Economic Commission for Europe
ECLAC	Economic Commission for Latin America and the Caribbean
EIS	Environmental Information Services (UNEP DEIA&EW)
ELMS	Environment and Land Management Sector (SADC)
EMPRES	Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (FAO)
ENRIN	Environmental and Natural Resource Information Network (UNEP)
EPA	Environmental Protection Agency (United States of America)
EPIRB	emergency position-indicating radio beacon
EROS	Earth Resources Observation Satellite
ERS	European remote sensing satellite
ESA	European Space Agency
ESCAP	Economic and Social Commission for Asia and the Pacific
ESCWA	Economic and Social Commission for Western Asia
ESRI	Environmental Systems Research Institute (United States)
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
Eurostat	Statistical Office of the European Communities
EUTELSAT	European Telecommunications Satellite Organization
FAME	Forest Assessment and Monitoring Environment (Netherlands/FAO)
FAME-URS	FAME User Requirements Study
FANR	Food and Natural Resources (SADC)
FAO	Food and Agriculture Organization of the United Nations
FGDC	Federal Geographic Data Committee (USGS)
FIVIMS	Food Insecurity and Vulnerability Information and Mapping System
FLAME	forest lands assessment and monitoring environment
FRA	Forest Resources Assessment (FAO)
GARS	Geological Applications of Remote Sensing Programme (UNESCO/IUGS)

GAW	Global Atmosphere Watch (WMO)
GCMD	Global Change Master Directory (NASA)
GCOS	Global Climate Observing System (ICSU/IOC/UNEP/WMO)
GDTA	Aerospace Remote Sensing Development Group
GEF	Global Environment Facility
GEWEX	Global Energy and Water Cycle Experiment (WCRP)
GIEWS	Global Information and Early Warning System
GII	global information infrastructure
GIS	Geographic Information Systems
GLONASS	Global Navigation Satellite System (Russian Federation)
GMDSS	Global Maritime Distress and Safety System (IMO/ITU/International Hydrographic Organization/WMO)
GMPCS	global personal communications by satellite
GNSS	global navigation satellite systems
GOIN	Global Observation Information Network
GOOS	Global Ocean Observing System (ICSU/IOC/UNEP/WMO)
GOS	Global Observing System (WMO)
GOSSP	Global Observing Systems Space Panel
GPS	Global Positioning System
GRID	Global Resource Information Database (UNEP)
GSFC	Goddard Space Flight Center (NASA)
GTOS	Global Terrestrial Observing System (FAO/ICSU/UNEP/ UNESCO/WMO)
GTS	Global Telecommunications System (WMO)
HYCOS	Hydrological Cycle Observing System (WMO)
IACCA	Inter-Agency Committee on the Climate Agenda
IADC	Inter-Agency Space Debris Coordination Committee
IAEA	International Atomic Energy Agency
IAI	Inter-American Institute for Global Climate Change
ICAMS	Integrated Coastal Assessment and Monitoring System (FAO-SDRN)
ICAO	International Civil Aviation Organization
ICIAR	International Centre for Integrated Antarctic Research
ICIMOD	International Centre for Integrated Mountain Development
ICMP	Illicit Crops Monitoring Programme (UNDCP)
ICSU	International Council for Science
IDN	International Directory Network (CEOS)
IDNDR	International Decade for Natural Disaster Reduction
IGAD	Intergovernmental Authority on Development
IGBP	International Geosphere-Biosphere Programme

IGBP	International Geosphere-Biosphere Programme
IGOS	Integrated Global Observing Strategy
IHP	International Hydrological Programme
IMO	International Maritime Organization
IMS	Internet Map Server
IMSO	International Mobile Satellite Organization
INFOCLIMA	World Climate Data Information Referral System (WMO)
INFOTERRA	Global Environmental Information Exchange Network (UNEP)
INPE	National Institute for Space Research (Brazil)
INTELSAT	International Telecommunications Satellite Organization
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOS	Initial Operational System
IPCC	Intergovernmental Panel on Climate Change
IRS	Indian Remote Sensing Satellite
ISDN	integrated services digital network
ISDR	International Strategy for Disaster Reduction
ISO	International Organization for Standardization
ITC	International Institute for Aerospace Survey and Earth Sciences
ITM-2000	International Telecommunication-2000
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
IUGS	International Union of Geological Sciences
JRC	Joint Research Center (European Commission)
LANDSAT	Land Remote Sensing Satellite
LAPAN	National Institute of Aeronautics and Space (Indonesia)
LCCS	Land Cover Classification System (FAO)
LEDO	Lebanese Environment and Development Observatory
LEO	low-Earth orbit
MAB	Man and the Biosphere Programme (UNESCO)
MACRES	Malaysian Center for Remote Sensing
MAP	Mediterranean Action Plan (UNEP)
MdD	Meta-data Directory tool (UNEP)
MED-HYCOS	Mediterranean Hydrological Cycle Observing System
MEO	medium-Earth orbit
MODIS	Moderate-Resolution Imaging Spectroradiometer
MRAC	Royal Museum of Central Africa (Belgium)
MSG	Meteosat Second Generation
NASA	National Aeronautics and Space Administration (United States of America)

NCRS	National Centre for Remote Sensing (Lebanon)
NDVI	normalized difference vegetation index
NESDIS	National Research Satellite, Data and Information Service (NOAA)
NGSS	next generation satellite systems
NIES	National Institute for Environmental Studies (Japan)
NOAA	National Oceanic and Atmospheric Administration (United States of America)
OAD	Overall Assessment of Desertification
OSS	Sahara and Sahel Observatory
PANGIS	Pan-African Network for a Geological Information System
PDUS	primary data user station
ProMIS	Programme Management Information System
RAMSES	Reconnaissance and Management System of the Environment of Schistocerca (FAO)
RAPIDE	AfricanNetwork for Integration and Development
RCSSMRS	Regional Centre for Services in Surveying, Mapping and Remote Sensing
RECTAS	Regional Centre for Training in Aerospace Surveys (ECA)
REIMP	Regional Environmental Information Management Project
RESAP	Regional Space Applications Programme
RICAP	Regional Inter-Agency Committee for Asia and the Pacific (ESCAP)
RMTC	Regional Meteorological Training Centre (WMO)
RRSP	Regional Remote Sensing Project (FAO)
RRSU	Regional Remote Sensing Unit (SADC)
SADC	Southern African Development Community
SADC-HYCOS	Southern African Development Community Hydrological Cycle Observing System
SAR	synthetic aperture radar
SARPs	Standardsand Recommended Practices (ICAO)
SCEP	State Committee for Environmental Protection (Russian Federation)
SDRE	Extension, Education and Communication Service (FAO)
SDRN	Environment and Natural Resources Service (FAO)
SITA	International Society of Aeronautical Telecommunications
SMA/SMC	State Meteorological Administration/Satellite Meteorology Centre (China)
SOLAS	International Convention for the Safety of Life at Sea
SOTER	Soils and Terrain Digital Database (FAO/International Soil Reference and Information Center/UNEP)
SPREP	South Pacific Regional Environment Programme

STRIM	space techniques for major risks management pogramme
TACIS	Technical Assistance for CIS countries
TCO	terrestrial carbon observations
TELECOM	World Telecommunication Exhibition and Forum (ITU)
UNDCP	United Nations International Drug Control Programme
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNISPACE III	Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space
UNITAR	United Nations Institute for Training and Research
USAID	United States Agency for International Development
USFS	United States Forest Service
USGS	United States Geological Survey
USGS-EDC	United States Geological Survey EROS Data Center
WAFC	orld Area Forecast Centre
WAFS	World Area Forecast System
WAICENT	World Agricultural Information Centre (FAO)
WCMC	World Conservation Monitoring Centre
WCRP	World Climate Research Programme (ICSU/IOC/WMO)
WFP	World Food Programme
WGISS	Working Group on Information Systems and Services (CEOS)
WHO	World Heath Organization
WHYCOS	World Hydrological Cycle Observing System (WMO)
WiFS	Wide Field Sensor
WIPO	World Intellectural Property Organization
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WRCs	world radiocommunication conferences (ITU)
WTDC	World Telecommunication Development Conference
WTPF	World Telecommunication Policy Forum (ITU)
ZOU	Zimbabwe Open University

Introduction

1. The present report was prepared by the Secretary-General at the request of the Committee on the Peaceful Uses of Outer Space. It describes activities of organizations within the United Nations system promoting the practical application of space technology in developing countries.

2. The report is based on contributions submitted by the organizations concerned in response to the United Nations' request for information on concrete programmes of work, primarily for 2000 and 2001, and was finalized at the Inter-Agency Meeting on Outer Space Activities, held at Vienna from 2 to 4 February 2000.

3. The report consists of three chapters. Chapter I contains a list of organizations involved in outer space activities within the United Nations system and a matrix identifying the activities of each organization within specific fields. Chapter II summarizes major activities and programmes planned for 2000, 2001 and future years by organizations within the United Nations system. Chapter III details concrete programmes of individual organizations under subsections on remote sensing and geographic information systems (GIS) (section A), communications and navigation (section B), meteorology and hydrology (section C), basic space science (section D), safety and disaster reduction (section E), as well as other activities in the field of space science and technology and its applications (section F).

4. Sections A, B and C each contain three subsections, each describing a different type of development assistance activity: education and training programmes, expert services and survey missions; and dissemination and exchange of information. Section A, on remote sensing and GIS, contains an additional subsection on "Capacity-building", reflecting the strong focus on developing indigenous capacity within this field. Section B, on communications and navigation, contains two additional subsections, on "Regulation of the use of the geostationary satellite orbit and the radio-frequency spectrum allocated to space communication services" and "Studies on and/or preparations for the establishment of new legal frameworks or the development of new systems to complement the existing legal frameworks", reflecting the focus on legal aspects of this field.

5. Some of the activities discussed in the report could be reasonably included under more than one subheading. Activities to develop and improve databases are classified as "studies or pilot projects", whereas those to operate databases after development are classified as "dissemination or exchange of information". Meetings of decision makers are classified as "dissemination of information", rather than "education and training programmes", if their purpose is the exchange of opinions and the elaboration of strategies or plans for future activities.

I. Participants in outer space activities within the United Nations system and matrix of outer space programmes

6. The participants in outer space activities within the United Nations system included the following Secretariat units, bodies, research institutes, specialized agencies and other organizations: Office for Outer Space Affairs, International Decade for Natural Disaster Reduction (IDNDR) secretariat, Economic Commission for Europe (ECE), Economic and Social Commission for Asia and the Pacific (ESCAP), Economic Commission for Latin America and the Caribbean (ECLAC), Economic Commission for Africa (ECA), Economic and Social Commission for Western Asia (ESCWA), United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), United Nations Institute for Training and Research (UNITAR), Food and Agriculture Organization of the United Nations (FAO), United Nations Educational, Scientific and Cultural Organization (UNESCO), International Civil Aviation Organization (ICAO), World Health Organization (WHO), World Bank, International Telecommunication Union (ITU), World Meteorological Organization (WMO), International Maritime Organization (IMO), World Intellectual Property Organization (WIPO), United Nations Industrial Development Organization (UNIDO) and International Atomic Energy Agency (IAEA).

7. A matrix of outer space programmes within the United Nations system is presented below.

Participants in outer space activities and matrix of outer space programmes[a]

United Nations entity	*Remote sensing*	*Communications and navigation*	*Meteorology and hydrology*	*Basic space science*	*Safety aspects and natural disaster reduction*	*Other activities*
OOSA[b]	26, 34, 38, 44, 45, 76	147, 149		233-236	242, 254, 255	256-267, 271
DESA	38					
OCHA	130				245, 253	
ISDR secretariat					239-241, 253	
UNDCP	74-77					
UNEP	27, 35, 44, 46-73, 83, 100-105, 121-133	153-160	201-205, 221, 228-230		245, 246	
ECA	28, 29, 39, 78, 106, 107, 114	141, 150, 161, 162, 177, 181				
ECE	108, 130					
ESCAP	36, 43, 44, 79, 109-111, 115, 116, 128, 134	142, 158, 163, 164, 178, 179, 183	222, 231	237, 238	243, 244	268-270
UNDP	65, 70, 96, 126, 128, 130, 137		207			
UNITAR	52, 130					
FAO	37, 40-42, 44, 46-48, 53, 68, 77, 80-91, 112-113, 117-119, 127, 135-138	165, 182	220, 228, 229, 232		246	
UNESCO	31-33, 44, 46-48, 73, 83 90, 92-99, 120, 139, 140	151, 157, 166-172, 190	198, 203-206, 208, 217, 218, 223, 225, 228-230		249, 250	272
UNIDO						258
ICAO		143, 191, 193-196	219			
WHO	130					
ITU		144-146, 148, 152, 171-176, 180, 184-189, 197			248, 251-253	
WMO	44, 46-48		199, 200, 203-205, 207-219, 224-230			
IMO		192-194	217		247, 248	
World Bank	84, 126, 130		207			
IAEA					254, 255	

[a] The numbers in each column indicate the relevant paragraphs in the present report.

[b] Office for Outer Space Affairs of the Secretariat.

II. Summary of major activities and programmes planned for 2000 and 2001 and future years

8. Organizations within the United Nations system have planned activities for 2000 and 2001 and future years within the fields of remote sensing and GIS, communications and navigation, and meteorology and hydrology. Valuable space-related or space-aided activities in basic space sciences, improvement of safety and disaster reduction, as well as other activities related to space science and technology and its applications will also be conducted by organizations within the United Nations system.

9. The planned activities range from education and training to operational applications of technologies. Three categories of activities are notable in most of the above-mentioned fields of space activities. The first category to be noted is education and training programmes, which are generally offered by holding training courses, workshops and seminars or supporting fellowships. Efforts are being made to improve the educational and training environment by providing educational tools.

10. Secondly, organizations within the United Nations system provide expert services and conduct survey missions to identify specific areas of applications relevant to a given country or group of countries. Specific studies and projects in a country or group of countries are also being conducted. In recent years, there has been increasing emphasis on maximizing the benefits from space activities for social and economic development through operational applications of existing space technologies. A number of projects with this emphasis are carried out at the local, regional or global level.

11. Thirdly, dissemination of information on the status of technology and on operational systems has always been an important element in space activities. Organizations within the United Nations system issue numerous recurrent or non-recurrent publications on emerging new space technologies. The publications also contain suggestions on possible applications of those technologies. More information is being distributed through computer networks, which in turn stimulates demand for the further development of databases. The use of the Internet and its various services, including electronic mail, File Transfer Protocol, name lists and the World Wide Web, is considered a very appropriate means of improving coordination among the organizations of the United Nations system, and efforts are being made to further expand the use of the Internet for such purposes.

12. In the field of remote sensing, the United Nations and its specialized agencies have planned a number of international, regional and national training courses and workshops, sponsored fellowships, developed training materials and offered training facilities. Training courses and workshops cover remote sensing applications in general as well as specialized topics such as sustainable development of natural resources and energy, management of natural resources and the environment, land-cover mapping and land-use planning. Most of these international and regional training courses are jointly organized by two or more organizations within the United Nations system, often in cooperation with other international organizations and/or Governments.

13. Many organizations of the United Nations system offer expert services and carry out projects related to remote sensing technologies and GIS. These technologies are applied to a wide range of activities, such as environmental monitoring and management, management of natural resources and disasters, early warning for food security, land-cover mapping and land management, forest planning and management, mapping of desertification, monitoring of cultural sites and disease control. Organizations of the United Nations system are involved in a number of activities aimed at establishing databases or information networks at the regional or global level, such as the Integrated Global Observing Strategy (IGOS), the Global Terrestrial Observing System (GTOS), the illicit crops monitoring programme of the United Nations International Drug Control Programme, the Land Cover Map and Geodatabase for Africa (AFRICOVER), the Regional Environmental Information Management Project (REIMP) for Central Africa, the Africa Real-Time Environmental Monitoring Information System (ARTEMIS), the Geological Applications of Remote Sensing (GARS) programme, the Global Resource Information Database (GRID) and the Integrated Coastal Assessment and Monitoring System (ICAMS), to name but a few.

14. In the area of dissemination of information, organizations either provide information upon request or issue recurrent or non-recurrent publications concerning technological status or existing operational systems to increase awareness of the useful applications of remote sensing technologies. Reflecting the rapid expansion of the information superhighway with the use of computer

networks, an increasing number of organizations are establishing databases that will tremendously increase the availability of data of interest for a larger number of users. It should be noted that meetings of experts or decision makers and workshops organized within the United Nations system also provide opportunities to exchange updated technological or policy-related information that is vital in elaborating regional or global strategies for social and economic development with the use of remote sensing technologies.

15. There will be a number of activities within the United Nations system with the particular objective of capacity-building in developing countries in the use of remote sensing and GIS technologies. Most of the efforts will be directed towards the strengthening of operational capability of existing regional or national institutions involved in environmental management for sustainable development, food security, natural resource monitoring or land-cover mapping. Especially within the framework of field projects, the development of human resources is considered an important factor.

16. In the field of communications and navigation, the United Nations system will continue to organize training courses, workshops and seminars and provide fellowship support for in-depth training. As far as expert and technical advisory services are concerned, organizations within the United Nations system participate in the development of domestic or regional satellite communication systems for various purposes such as improving distance education, medicine, increasing public awareness in environmental protection and supplementing early warning systems for natural disaster reduction and food security. Satellite communication systems are also considered a vital tool for social and economic development, particularly for rural and remote areas in developing countries. Satellite communication systems are also used to improve communications between the headquarters and the regional offices of the organizations or among their regional offices, as demonstrated by the Mercure satellite telecommunications system.

17. The results or interim reports of the projects or studies on the use of satellite technology conducted within the United Nations system are also available in the form of recurrent or non-recurrent publications or disseminated in electronic form through computer networks.

18. In view of the rapid increase in the use of frequency bands for various services, efforts are being made to update the international radio regulatory process and to prepare for future requirements. The spectrum/orbit resources allocation procedure has been reviewed with a view to increasing efficiency and equity in spectrum/orbit utilization. The detailed regulatory texts contained in the international Radio Regulations of ITU have been subsequently modified and new regulatory provisions resulting from the review are now in force.

19. The work of the specialized agencies of the United Nations is also making significant contributions in the area of applications of space technology for land, maritime and aeronautical mobile communications. Studies on a worldwide radio-navigation system are being conducted within the United Nations system. As the operational availability of the Global Positioning System (GPS) and the Global Navigation Satellite System (GLONASS) is limited, consideration is being given to a post-GPS/GLONASS system. In order to meet future civil aviation requirements, efforts are being made to improve air navigation systems, including space elements.

20. The application of satellite technology constitutes an important element of technical cooperation activities in operational meteorology and hydrology. Several training programmes are planned for 2000 and 2001 to discuss various subjects such as satellite meteorology, tropical meteorology and marine studies.

21. Efforts continue to be made to develop a marine and coastal zone data information system, to improve management of water and coastal resources, to upgrade meteorological observations by installing networks of data collection platforms (DCPs) and to improve the meteorological telecommunication system by planning the implementation of regional meteorological telecommunication networks in various regions. Reflecting the increasing awareness of global changes, including climate change, as well as their impact on global, regional and national economies, organizations within the United Nations system also cooperate in global schemes, such as IGOS, the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), the World Weather Watch, World Area Forecast System (WAFS), the Global Atmosphere Watch (GAW), the World Climate Research Programme (WCRP) and the World Climate Data and Monitoring Programme. A number of technical reports on climate research, ocean observations and water-resource management are also published.

22. Efforts continue to be made to support space research activities of scientists from developing countries by

sponsoring their participation in international meetings relating to space science.

23. Organizations within the United Nations system also make efforts towards the improvement of safety in various human activities. While studies are under way to apply space technology to establish safety and early warning systems, such as early warning systems for the reduction of disasters, the Global Maritime Distress and Safety System (GMDSS) supporting search and rescue services at sea became fully operational in 1999. The United Nations International Strategy for Disaster Reduction (ISDR) programme will work to continue the achievements of IDNDR, which came to an end in December 1999.

24. Further progress has been made towards the establishment and full operation of United Nations-affiliated centres for space science and technology education in Asia and the Pacific, Latin America and the Caribbean, Africa and western Asia and a network of space science and technology education and research institutions for central-eastern and south-eastern Europe.

25. The United Nations and its specialized agencies will continue to coordinate and develop their activities involving space science and technology and to emphasize the actual and potential contribution of space science and technology to human well-being. Starting in 2000 and 2001, particular attention will be given to implementing the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), endorsed by the General Assembly in its resolution 54/68 of 6 December 1999, by further enhancing the cooperation and coordination of space-related activities within the United Nations system.

III. Activities planned by organizations within the United Nations system for 2000 and 2001 and future years

A. Remote sensing and geographic information systems

1. Education and training programmes

Training courses, workshops and seminars

26. The United Nations Programme on Space Applications is planning the following training courses in 2000-2001:

(a) Tenth United Nations International training Course on Remote Sensing Education for Educators, organized in cooperation with the Government of Sweden, to be held at Stockholm and Kiruna, Sweden, from 2 May to 9 June 2000;

(b) Eleventh United Nations/Sweden International Training Course on Remote Sensing Education for Educators, to be held at Stockholm and Kiruna, Sweden, in 2001.

27. The Environmental Assessment Programme for Asia and the Pacific (UNEP/EAP, AP) of UNEP will conduct the following training programmes in the years 2000 and 2001.

(a) Advanced training in remote sensing for 10 participants from India in 2000;

(b) Two internships for the countries participating in a land-cover project in 2000 and 2001;

(c) One training programme on the application of remote sensing and GIS to the study of glacier lake outburst flooding in 2000 for six participants from Bhutan and Nepal;

(d) A two-week training programme entitled "Introduction to Remote Sensing and GIS" for 15 participants from Anhui Province of China.

28. During 2000 and 2001, ECA will organize the following training workshops, seminars and meetings:

(a) A workshop on new database development technologies and on the organization and management of development information, including dissemination on the web and use of geo-information in statistical offices, to be held in October/November 2000;

(b) A seminar on standards and specifications for spatially referenced information adapted to Africa's environment to expand GIS networking, to be held in March 2001;

(c) A workshop for decision makers on GIS, addressing selected spatial applications, to be held in September 2001.

29. During 2000 and 2001, the Regional Centre for Mapping of Resources for Development (RCMRD) of ECA will organize short-term courses covering several application areas of remote sensing and GIS.

30. The Regional Centre for Training in Aerospace Surveys (RECTAS) of ECA will continue to provide regular long-term training courses on remote sensing and GIS, 18-month courses for technicians and technologists, and 12-month courses for postgraduates. Customized short training courses, seminars and workshops on remote sensing and GIS applications will also be organized upon request.

31. UNESCO will support the following postgraduate training courses in 2000, 2001 and beyond:

(a) International postgraduate courses on remote sensing and GIS technologies, including digital image processing, for mineral resource management, coastal zone management and geomorphological surveying and investigations held by the International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, Netherlands;

(b) Training courses on the applications of remote sensing and GIS to geological exploration and to the study of natural hazards of geological origin held by the Aerospace Remote Sensing Development Group (GDTA), Toulouse, France.

32. Within the framework of the Man and the Biosphere (MAB) programme, UNESCO will continue to organize training courses on remote sensing and GIS technologies for biosphere reserve managers in developing countries and to develop pilot projects on the operational use of GIS. Remote sensing and GIS technologies were introduced in biosphere reserve management by UNESCO in cooperation with Conservation International, Intel (United States of America) and the Nippon Electric Company (Japan).

33. UNESCO is developing, in cooperation with ITC and the World Wildlife Fund, a training programme on remote sensing and GIS for the rehabilitation of panda habitats in China. The training programme is for both scientists and managers.

Fellowships

34. The United Nations Programme on Space Applications and the European Space Agency (ESA) are working together on a reorientation of the fellowships for research and study in remote sensing instrumentation at the European Space Research and Technology Centre at Noordwijk, Netherlands, and in remote sensing information systems at the European Space Research Institute at Frascati, Italy.

35. UNEP/EAP.AP will provide funding in the year 2000 or 2001 for one person to study for a master's degree at the Asian Institute of Technology (AIT), Thailand.

36. ESCAP will continue to provide medium-term and long-term fellowships in 2000 and 2001 for training on remote sensing and GIS in specialized educational institutions in the Asian and Pacific region.

Provision of training materials or facilities

37. FAO is developing cooperation with educational institutions with the objective of responding to training and capacity-building needs of developing countries in relation to space applications for natural resources management, environmental monitoring and distance education.

2. Expert services and survey missions to identify specific areas of applications relevant to a given country or group of countries and to carry out specific studies on pilot projects or to implement the projects with operational applications of technology

Provision of expert services and survey missions

38. In 2000 and beyond, the Office for Outer Space Affairs of the Secretariat, within the framework of the United Nations Programme on Space Applications, will continue to collaborate with the Department of Economic and Social Affairs of the Secretariat and ESA in follow-up projects resulting from the training courses, held at Frascati, Italy, in 1993, 1994, 1995 and 1997, on applications of data from the European remote sensing satellite (ERS) and other satellites to natural resources, renewable energy and the environment. The Office will provide the necessary technical assistance, support and expertise required for completing an ongoing project in Latin America (Argentina, Bolivia, Chile), as well as for implementing projects in Asia and the Pacific (Viet Nam) and Africa (Regional Training Centre for Agrometeorology

and Operational Hydrology and their Applications (AGRHYMET), Niger). These projects, aimed at strengthening the capability to use satellite data for resource management, will benefit from an integrated approach in technical cooperation, supported by the work of the Commission on Sustainable Development related to the implementation of Agenda 21, that incorporates satellite-based technologies with concrete applications of methodologies and guidelines.

39. ECA will continue to provide advisory services to member States and to regional and subregional institutions upon request on issues related to remote sensing and GIS.

40. Following the successful completion of Phases I and II of the FAO/United States Agency for International Development (USAID) project on the monitoring, forecasting and simulation of the Nile River, FAO is implementing Phase III of the project during the period from 1997 to 2001 to assist the Government of Egypt in consolidating the results achieved in the earlier phases. Phase III of the project is focused on further consolidation of the Nile River Monitoring and Forecasting System. The related control/decision support system has been approved, and implementation commenced in 1998. In relation to this programme, a first phase of a capacity-building programme for the management and development of the Nile resources, covering the entire Nile basin, has been completed and is presently being followed by a second phase, supported by the Government of Italy, with emphasis on: (a) regional basin management and planning; (b) legal and institutional development; and (c) planning and implementing sub-basin action programmes.

41. In addition to global and regional projects, FAO, through its Environment and Natural Resources Service (SDRN), is currently executing or providing technical backstopping to some 60 field projects with a major remote sensing, GIS and information management system component in more than 50 developing countries in Africa, Asia, Latin America and the Caribbean and central and eastern Europe, including Afghanistan, Azerbaijan, Bangladesh, Bulgaria, Brazil, Burundi, Eritrea, Lithuania, Malta, Pakistan, Peru and Tunisia. FAO is also actively involved in developing and field testing new remote sensing methodologies through pilot projects in a number of countries, including inventory and monitoring of shrimp farms in Sri Lanka, wetlands mapping and assessment in Zambia using synthetic aperture radar (SAR) data of ERS, and groundwater exploration in the Syrian Arab Republic using satellite remote sensing combined with GIS technology. In countries with economics in transition, FAO offers advice on the use of remote sensing and GIS in planning and implementing agricultural land reform and in assessing and monitoring environmental damage. At present, such assistance is being provided to Albania, the Czech Republic, Hungary, Poland and Slovakia. In 1999, FAO completed and published a report on inventory and monitoring of shrimp farms in Sri Lanka using SAR data of ERS.

42. FAO has started to collaborate in a pilot project in Mali that aims to define a national operational information system for both food security and desertification control. Furthermore, FAO, in the context of ARTEMIS, cooperates closely with a number of European universities and private sector entities in the development and testing of ERS scatterometer data for drought monitoring in the Sahel and Ukraine, with support from the ESA Data User Programme (DUP).

43. ESCAP will undertake technical advisory services on space technology applications for natural resource management and environmental monitoring in its member States, upon request of Governments.

Studies, pilot projects and operational applications

44. In 2000 and 2001, the Office for Outer Space Affairs, ESCAP, UNEP, FAO, the Intergovernmental Oceanographic Commission (IOC) of UNESCO and WMO will continue to contribute to the work of the Committee on Earth Observation Satellites (CEOS) as associate members.

45. In 2000, the Office for Outer Space Affairs will contribute to the work of an ad hoc working group established by CEOS to prepare a strategy for future activities of CEOS in education and training in developing countries, as well as of an ad hoc working group on disaster management also created by CEOS at its thirteenth plenary meeting

46. FAO, the International Council for Science (ICSU), UNEP, UNESCO and WMO are founding members of GTOS. The central mission of GTOS is to provide policy makers, resource managers and researchers with decision support tools and access to the data needed to detect, quantify, locate, understand and warn of changes (especially reductions) in the capacity of terrestrial ecosystems to support sustainable development. GTOS focuses on five issues of global concern: changes in land quality; availability of freshwater resources; loss of biodiversity;

pollution and toxicity; and climate change. GTOS aims to provide guidance in data analysis and to promote: (a) integration of biophysical and socio-economic geo-referenced data; (b) interaction between monitoring networks, research programmes and policy makers; (c) data exchange and application; and (d) quality assurance and harmonization of measurement methods.

47. FAO-SDRN hosts the GTOS secretariat at its headquarters on behalf of the GTOS sponsors. The GTOS secretariat, under the guidance of the GTOS steering committee, is currently developing a global terrestrial observing network and a terrestrial ecosystems monitoring sites meta-database, and is planning to hold joint regional workshops with GCOS to formulate regional activities. A GTOS workshop was held for the eastern European region in Budapest, Hungary, in September 1999, and another for the southern African region will be held in Pretoria, South Africa, in January 2000. Closer cooperation is also envisaged with other parties in the framework of priorities identified by the partners in IGOS, including in particular a theme on terrestrial monitoring, initially involving the estimation of global net primary productivity, and a theme on monitoring the carbon cycle, initially involving global mapping and monitoring of carbon sources and sinks. For the latter, following formal endorsement of the IGOS Terrestrial Carbon Observations Theme at the thirteenth plenary meeting of CEOS held in Stockholm in November 1999, a planning meeting for future activities will be held in Ottawa in February 2000. GTOS is also actively developing subregional networks in eastern Europe and southern Africa.

48. Within the framework of the Man and the Biosphere Programme (MAB) programme, UNESCO will continue to cooperate with UNEP, FAO, WMO and the International Geosphere-Biosphere Programme (IGBP) of ICSU concerning GTOS, notably through its World Network of Biosphere Reserves (357 sites in 90 countries). Two initiatives are being developed for 2000-2001 and beyond. One is the use of biosphere reserves as ground truth sites for the GTOS project on net primary productivity, which is coordinated through the International Long-Term Ecological Monitoring Programme in cooperation with the National Aeronautics and Space Administration (NASA) of the United States. The second is the development of a Biosphere Reserves Integrated Monitoring (BRIM) programme aimed at improving exchange of information among biosphere reserves, including information obtained by remote sensing and GIS applications.

49. UNEP, through its GRID network, maintains linkages with providers and users of remote sensing and information technology applications in many countries to support an assessment framework for reviewing the state of the global environment and environmental issues of international significance. The GRID network now consists of 15 centres. Four of them, UNEP/EAP.AP-Bangkok, GRID-Geneva, GRID-Nairobi and GRID-Sioux Falls, have a UNEP staff presence. GRID-Arendal is operated as a private foundation supported by the Government of Norway, through direct support to UNEP, in accordance with a memorandum of understanding between the partners. The other centres of the GRID network are at the following locations: the International Centre for Integrated Antarctic Research (ICIAR), Christchurch, New Zealand; the National Institute for Environmental Studies (NIES), Tsukuba, Japan; the International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal; the National Institute for Space Research (INPE), São José dos Campos, Brazil; the Canada Centre for Remote Sensing (CCRS), Ottawa; Warsaw; Ministry of the Environment, Budapest; Blue Plan Office Regional Activity Centre of the Mediterranean Action Plan (MAP); Moscow, within the Russian Federation's State Committee for Environmental Protection (SCEP); and most recently, at the Ministry of Environment in Tbilisi, Georgia. The results of activities of those centres are shared through the GRID network and archived at the regional GRID centres at Bangkok, Geneva and Nairobi.

50. GRID centres continue to produce, add value to, and disseminate data sets useful for environmental assessment. UNEP will place greater emphasis on bringing the centres closer together and is considering the creation of a steering committee to oversee the development of a more integrated operation. The GRID centres continue to serve as the foundation for UNEP Environmental and Natural Resource Information Network (ENRIN) projects, implemented by cooperation agreements with governmental and intergovernmental organizations in developing countries and countries with economies in transition to create environmental assessment and reporting networks. ENRIN projects are intended to promote the flow of information on environmental assessment between partner institutions and UNEP; provide for policy and planning consultations related to international environmental assessment and reporting; and provide a vehicle to catalyse and facilitate capacity-building of participating institutions.

51. UNEP, through GRID-Geneva, maintains up-to-date databases of human population density and distribution for

the Asian continent and the Russian Federation. The data sets were developed using GIS modelling techniques and the most recently available data on subnational administrative boundaries and human population at the third (district) administrative level. The GIS model is based on an "accessibility index" and the tendency of people to cluster near existing centres of population and along the transportation infrastructure. The final gridded GIS data sets can be used for a wide variety of applications, including assessment of human impacts on the environment, agriculture and poverty mapping. The report and results of this project are available at the web site (http://www.grid.unep.ch).

52. UNEP/GRID-Geneva, in cooperation with UNITAR, initiated a project entitled "GISWeb Africa" in 1999, as part of the Systems to Monitor the Environment through the Internet (SISEI)—Afrique project (A/AC.105/700, para. 123). The "GISWeb Africa" project, developed using a standard and well-known software, has two basic on-line functionalities: one for consultation, display and printing of georeferenced data; and another to query the data through logical and mathematical operators. The resulting application is currently being distributed on CD-ROM, and it is planned to make the application available through the Internet in the year 2000.

53. UNEP/GRID-Geneva will be initiating a new project in 2000 on land-cover mapping. The aims of the project are: (a) to examine different methodologies used for land-cover mapping (such as the FAO Land Cover Classification System (LCCS)); (b) to make existing land-cover data comparable and thus more effective for analyses of land cover and land-cover changes at regional or global levels; and (c) to derive biodiversity-related information from land-cover maps. In order to achieve this, GRID-Geneva intends to produce a land-cover and biodiversity map for the northern part of Madagascar.

54. UNEP, through GRID-Geneva, continues to undertake pilot studies on the use of GIS for the prevention and resolution of existing or potential environmental conflicts. Building on previous experimental applications (A/AC.105/700, para. 67), a new study was carried out in 1999 for the Nile River basin. The studies all aim to use GIS, the Internet and the World Wide Web as tools to collect and distribute relevant spatial data and information, and to inform all parties in a situation of potential environmental conflict of alternative solutions that can be displayed on-line. A report and results of these activities are available at the web site (http://www.grid.unep.ch).

55. UNEP will continue to operate its North American node of GRID in cooperation with NASA, the United States Geological Survey (USGS), the United States Forest Service (USFS) and the United States Environmental Protection Agency (EPA).

56. UNEP, through GRID-Sioux Falls, will maintain access to the world-class expertise and unique facilities of the USGS Earth Resources Observation Satellite (EROS) Data Center (USGS-EDC), EPA, NASA and USFS, in the use of applied data and information technology for the benefit of developing countries. UNEP, through GRID-Sioux Falls, has been active in the design, development and timely delivery of scientifically credible information products, recognizing that it is a formidable challenge to provide decision makers with information useful for environmental planning, management and policy formulation in a timely manner and understandable formats. USGS-EDC is the largest satellite data centre in the world, with about 600 scientists. Extensive partnerships with the private sector, non-governmental organizations, scientific bodies and academic institutions have been established.

57. UNEP will, through GRID-Sioux Falls, conduct the biannual survey of spatial software technologies in 2000 to assess the status and trends of the technologies and to provide this information to developing countries.

58. UNEP will continue to use the facilities at GRID-Sioux Falls to derive methods for policy-relevant analysis using geospatial data and information.

59. UNEP will continue its efforts towards the completion of comprehensive and globally consistent data sets relating to global land cover, digital elevation, drainage basins, population and forest vegetation in cooperation with agencies around the world.

60. UNEP/EAP.AP-Bangkok, together with the Joint Research Center (JRC) of the European Commission, located in Ispra, Italy, is conducting a study on monitoring deforestation of selected sites in Myanmar. The results will be presented in a workshop planned for early 2000 in Jakarta, Indonesia. UNEP/EAP.AP-Bangkok, together with JRC, is also conducting a research project to test the usefulness of "VEGETATION" data for forest-cover monitoring in Indochina.

61. UNEP/EAP.AP-Bangkok, with financial assistance from the Asian Development Bank, prepared a 1:1 million database of the greater Mekong subregion, which is being used to prepare the Strategic Environmental Framework for

the Greater Mekong Subregion. The database consists of both biophysical and socio-economic information.

62. UNEP/EAP.AP-Bangkok is initiating a project to monitor glacier lake outburst flooding in the Hindu Kush/Himalayas, together with ICIMOD and relevant national agencies.

63. UNEP/EAP.AP-Bangkok, together with the National Institute of Aeronautics and Space (LAPAN), Indonesia and the Malaysian Center for Remote Sensing (MACRES), is preparing a 1:250,000-scale GIS database on the islands of Borneo and Sumatra that will eventually be used to prepare fire-hazard maps and a forest-fire danger-rating index.

64. UNEP, through UNEP/EAP.AP-Bangkok, is cooperating with the Branch Office of the United Nations High Commissioner for Refugees (UNHCR) in Nepal to develop a database pertaining to environmental assessment and contingency planning for the areas around the refugee camps in eastern Nepal.

65. UNEP, through UNEP/EAP.AP-Bangkok and GRID-Sioux Falls, is cooperating with UNDP in a GIS remote sensing assessment of the Democratic People's Republic of Korea relating to agricultural relief and rehabilitation from recent disasters.

66. UNEP, through UNEP/EAP.AP-Bangkok, continues to undertake land-cover assessment and monitoring studies with subregional and national agencies. The assessment and monitoring of 13 countries has been completed. Land-cover analysis of Sri Lanka is currently being performed using data provided by the Indian Remote Sensing Satellite (IRS) Wide Field Sensor (WiFS).

67. UNEP, through GRID-Nairobi, continues to implement the East African Coastal and Marine Environment Resources Database and Atlas Project, known as EAF/14, stemming from the UNEP-brokered East African Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region (including Comoros, Kenya, France (Réunion), Madagascar, Mozambique, Seychelles, Somalia and the United Republic of Tanzania, all signatories to the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region). The overall objective of EAF/14 is to provide decision makers and the general public with a planning and management tool for developing their coastal resources. The project also aims to establish a GIS unit in collaborating agencies in each of the project countries, provide training in database management and GIS techniques and produce related printed materials. Thus far, two workshops have been held in the region, database managers have been trained, GIS units have been established in all of the countries, and preliminary textbooks have been produced. All of these activities are to continue during the year 2000.

68. Having completed the Soils and Terrain Digital Database (SOTER) on the scale 1:5,000,000 for Latin America, UNEP, together with the International Soil Reference and Information Centre and FAO, continues to advance the work and coverage of SOTER.

69. UNEP, through GRID-Arendal, will continue to work with the Consultative Group on International Agricultural Research (CGIAR) to investigate applications of geo-referenced data to agriculture and the environment.

70. UNEP will continue to explore actively means of cooperation with UNDP on ways to extend the results of the integrated socio-economic and environmental database developed for Rwanda by UNEP and Michigan State University in the United States to databases covering other countries and subregions.

71. Discussions have continued during 1999 between UNEP and the World Conservation Monitoring Centre (WCMC) to designate the latter institution as a UNEP "centre of expertise" for biodiversity and conservation and as an additional centre of the global GRID network. A final agreement is to be reached in 2000 between UNEP, WCMC and the Government of the United Kingdom of Great Britain and Northern Ireland on the relationship of WCMC to UNEP.

72. The UNEP Meta-data Directory tool (MdD), which was developed by the GRID centres to maintain the catalogue of worldwide GRID data sources, provides a stand-alone software system that allows users to enter metadata in a format compatible to large metadata systems. The package can be used on a stand-alone desktop computer. The maintenance and improvement of the MdD system was transferred to GRID-Geneva in 1998, and, through a partnership entered into with the NASA Goddard Space Flight Center (GSFC) and its Global Change Master Directory (GCMD) project, the MdD tool was fully corrected and updated in 1999. The updated product has been provided to the 15 GRID centres and at least an equal number of external institutions and potential users on-line as well as on CD-ROM. New and updated metadata are currently being collected by GRID-Geneva, which will

harmonize the metadata and provide them to NASA/GSFC for inclusion in the globally consulted GCMD.

73. UNEP and UNESCO will continue to work with the Scientific Committee on the Problems of the Environment of ICSU.

74. The United Nations International Drug Control Programme (UNDCP) will, in 2000 and 2001, continue to work towards developing strategies to eliminate or significantly reduce the illicit cultivation of the coca bush, the opium poppy and the cannabis plant by 2008, on the basis of the outcome of the twentieth special session of the General Assembly devoted to countering the world drug problem together, held in New York in June 1998. In order to achieve that objective, UNDCP will provide technical assistance to Governments in establishing or improving monitoring mechanisms, act as a catalyst in establishing information-gathering networks, and compile, assess and analyse data and information on illicit crops in order to provide independent, neutral and objective feedback to Governments through its illicit crops monitoring programme as part of an international network for the monitoring of illicit narcotic crops. The illicit crops monitoring programme utilizes, among others, satellite imaging technology for monitoring illicit crops.

75. During the period from January 2000 to December 2003, the illicit crops monitoring programme will focus on the implementation and initial maintenance of technical assistance projects, dissemination of survey methodologies, establishment of networks and strengthening of the capacity of UNDCP to analyse and report on the global level of illicit cultivation. One global project and six country projects, in Afghanistan/Pakistan, Bolivia, Colombia, the Lao People's Democratic Republic, Myanmar and Peru, are planned to be implemented. The projects have been designed to support Governments in understanding how to evaluate and select existing technologies to use data from satellite images, global navigation satellite systems (GNSS) and GIS. The projects will narrow knowledge gaps by transferring available technologies from industrialized countries to developing countries, which have an urgent need to monitor the status of illicit crop cultivation in their territory. ESA has been a partner in the illicit crops monitoring programme since December 1998 and since April 1999 has been conducting a study to define possible methodologies suitable for detecting illicit crops with the use of satellite images. ESA will assist UNDCP to ensure that the monitoring projects will have continuous access to satellite data, that renowned technical experts are involved and that solutions will be sought with the use of cutting-edge technologies in the area of remote sensing and GIS.

76. During 2000, the Office for Outer Space Affairs will continue to provide technical assistance to UNDCP as it develops, in partnership with ESA, a methodology for the use of satellite images to monitor illicit crop cultivation. The methodology thus developed will become part of the illicit crops monitoring programme and will be put at the disposal of interested Governments, as an element of the strategy to eliminate the illicit cultivation of the coca bush and opium poppy by 2008.

77. FAO cooperates with UNDCP and other concerned agencies on projects to determine the location of narcotic crop cultivation sites using satellite remote sensing data.

78. In 2000 and 2001, ECA will carry out a series of technical studies, including those listed below, which will deal with mapping, remote sensing and GIS:

(a) A technical compilation of success stories on the implementation of GIS for decision-making and a critical evaluation of the impact, costs and benefits of geo-information (fourth quarter, 2001);

(b) A study on the use of GIS in national statistical offices in selected African countries (October 2001).

79. ESCAP will develop pilot projects on the uses of space technology for natural resources management and environmental monitoring.

80 FAO, through ARTEMIS, will continue to support the operational monitoring of seasonal growing conditions and vegetation development over Africa, based on hourly Meteosat data and daily advanced very high resolution radiometer (AVHRR) data from the National Oceanic and Atmospheric Administration (NOAA) of the United States, for use in early warning for food security and desert locust control. This includes routine distribution of ARTEMIS images, containing information about rainfall and vegetation activity, by electronic means to users at FAO Headquarters and at regional and national levels. FAO continues to support the establishment and improvement of local reception and processing systems using low-resolution environmental satellites, including the development of improved interpretation techniques and user-friendly analysis software. In order to expand the capabilities of ARTEMIS, FAO, in cooperation with the European Commission through its Space Applications Institute of the Joint Research Centre (JRC), has implemented a routine flow of global 1-km resolution

"VEGETATION" data from the SPOT-4 satellite. This arrangement will be continued until 2003 under an FAO/European Union agreement on support for the European Union to the FAO Global Information and Early Warning System on Food and Agriculture (GIEWS). In December 1999, following the successful launch of the first Terra satellite by NASA, FAO signed a formal agreement with NASA on the development of the operational use of Earth observation data from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on Terra satellites in a variety of application fields within the FAO mandate. Similar discussions are taking place with the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and ESA concerning the future Meteosat Second Generation (MSG) and Envisat satellite missions respectively. FAO participates actively in the current European Union/EUMETSAT discussions on the upgrading of Meteosat primary data user station (PDUS) facilities on the African continent for MSG reception. Detailed information about the ARTEMIS system and its databases and software facilities can be found on (http://metart.fao.org).

81. Through the use of remote sensing and GIS technology, FAO is contributing to the development of schemes to control transboundary livestock diseases under the FAO Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) Programme. Earlier studies relating normalized difference vegetation index (NDVI) data sets from ARTEMIS to tsetse distribution and land utilization types in Nigeria and Togo led to the establishment of an operational information system to define policies for African animal trypanosomiasis control, under a regional project in Burkina Faso and Togo, supported by the Government of Belgium. Remote sensing is used to define technical concepts for tsetse control in countries where high-resolution satellite imagery is available to discern land utilization types. A project is currently being prepared to design maps and GIS to assist 11 western African countries affected by onchocerciasis. These programmes will benefit substantially in future years from the SPOT-4 "VEGETATION" and Terra-MODIS data available through ARTEMIS. GIS also plays a central role in the establishment of a "global livestock geography", comprising the production of 10-km resolution maps showing the distribution, over time, of the different livestock species worldwide.

82. FAO, through its Plant Protection Service (AGPP) in cooperation with SDRN, and with support from the Government of Belgium, has developed and implemented the Reconnaissance and Management System of the Environment of Schistocerca (RAMSES) within the framework of its EMPRES Programme. The objective of RAMSES is to improve the use of Meteosat and NOAA-AVHRR data for the early detection of locust breeding areas in Africa in association with locally collected, georeferenced field data and the historical desert locust database, covering the period from the later 1920s to the present, which resides at FAO in a dedicated GIS called "SWARMS". During 1999, increasing use has been made of the SPOT-4 "VEGETATION" data, which has distinct advantages over the NOAA-AVHRR data in terms of locational accuracy and area coverage. In the near future, the spectrally and spatially superior MODIS data is likely to further improve the detection and monitoring capacity for locust control.

83. FAO-SDRN has operated the AFRICOVER project since 1995. The project aims to establish a digital land-cover database for selected subregions in Africa. It produces land-cover maps on the scale 1:250,000 (1:1,000,000 and 1:100,000 in certain cases), using the same geographic references and projection system in Africa, as well as a common harmonized legend, with updated information on features including drainage, toponymy, roads and land cover. The project has been implemented through close cooperation between regional and national remote sensing centres and mapping agencies in Africa under the supervision of FAO. A further two-year phase of the AFRICOVER East Africa project was under consideration by the Italian Government in 1999 and is expected to commence in June 2000, with a focus on the application of, access to and distribution of established AFRICOVER datasets. FAO also cooperates with UNEP and UNESCO by participating in working groups on the harmonization of land-use and land-cover classification and is evaluating the potential of the AFRICOVER database for assisting in implementing environmental conventions, in particular the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, known as the Convention to Combat Desertification.

84. Since 1996, the World Bank, together with FAO, has been implementing the REIMP regional project in central Africa. This project aims at improving and strengthening the planning and management of natural resources in the countries of the Congo basin by providing the various stakeholders with appropriate environmental information.

The project involves some 100 organizations from the public, private and non-governmental sectors, which all work in a national and regional network structure. FAO is the lead agency for the normative as well as the technical control activities of the project which is supported by a multi-donor fund of more than $10 million involving the World Bank, the European Union, the Global Environment Facility (GEF) and Belgium, Canada and France. The main recent activities of the project include: (a) the preparation of a number of geodatabases and reviews on the environment, forest and land use; (b) capacity-building, provision of equipment and training; and (c) establishment of Internet-based thematic networks on main environmental priorities of the subregion (biodiversity, forestry, coastal zones). Particular attention is given in this project to involving the users of information at all decision-making levels. FAO involvement is planned to increase substantially in 2000.

85. In cooperation with a number of partners and with financial support from the European Union, FAO-SDRN designed ICAMS, which will support the management of coastal-area ecosystems through the monitoring of water quality, distribution of coastal resources and usage parameters from multiple Earth observation data, such as satellite data from SeaWIFS and future Envisat sensors, and *in situ* measurements. Such a system will provide data of appropriate spatial and temporal scales to address issues concerning coastal management, such as the origins, causes and implications of changes in coastal water quality on associated resources. The operational viability of the ICAMS approach is currently being demonstrated through pilot applications at three European sites that address a range of coastal management issues: monitoring eutrophication in the Po Estuary (Adriatic, Italy); a study of fisheries oceanography in the north Aegean (Greece); and risk assessment of "red tides" in Bantry Bay (Ireland). Efforts are also under way to apply the ICAMS concept to address coastal area management issues in the Nile Delta in Egypt as well as test sites in Albania and Tunisia.

86. The 1990 Forest Resources Assessment (FRA) project of the Forestry Department of FAO, a global survey of forest resources, demonstrated that, with the help of remote sensing, information on changes in forest and land use could be obtained on a pan-tropical basis in a cost-effective, timely and statistically sound manner. FAO concluded that such surveys, if continued over time, would lend factual support to global environmental researchers and policy makers by providing descriptions of the processes of change and the quantification of essential parameters on a reliable basis. In view of the information needs of the international community, in particular the need for studies on global changes, FAO has decided to continue to implement FRA on a regular basis in order to build consistent and reliable time-series observations of forest and land use. FAO is currently executing the global forest resource assessment for the year 2000, called "FRA 2000", which relies on the use of remote sensing for many of its components, ranging from coarse resolution global coverage for land-cover mapping to high- and very high-resolution multi-data satellite imagery for surveying global and regional forest and land-cover changes. FRA 2000 includes an active country capacity-building activity, allowing countries to participate actively in the assessment process. The Government of Finland and the FAO regular programme are supporting the remote sensing component of FRA 2000. Cost-sharing arrangements for the low-resolution mapping component have been made with USGS-EDC.

87. FAO considers forest-fire management an integral part of the conservation and sustainable management of forests, which is at the core of the FAO forestry programme. FAO will summarize global data on forest fires through FRA 2000 and will continue to forge partnerships and linkages with agencies involved in developing remote sensing techniques for detecting forest fires and wildfires, such as JRC of the European Commission.

88. With the Government of the Netherlands, FAO is developing a Forest Assessment and Monitoring Environment (FAME) concept. This programme aims at defining, developing and implementing a dedicated operational end-to-end satellite remote sensing capacity for providing real-time access to appropriate remote sensing data for supporting sustainable forest management at the sub-national level, complementary to the FRA programme. During 1998, FAO contributed to a comprehensive FAME User Requirements Study (FAME-URS), coordinated on behalf of the Government of the Netherlands by ITC, through the implementation of country studies in Brazil, Costa Rica, Malaysia and Nepal and participation in a FAME-URS workshop at ITC in November 1998. The FAME-URS final report and eight related technical documents were published in June 1999. A follow-up programme, entitled "Establishment of operational use of spatial data in forest and forest lands assessment and monitoring environment (FLAME)", focusing on coordinated capacity-building to support sustainable forest management at local and national levels, is presently under

discussion between the Government of the Netherlands and FAO.

89. Under the coordination of its central GIS Unit, housed in SDRN, and in cooperation with the relevant technical divisions, FAO has developed and is using several pilot GIS databases to evaluate marine resources, integrated terrain units and waterbasins in Africa.

90. A number of GIS analysis and applications projects are being implemented. These include: (a) preparation of the GIS vector and raster versions of the FAO/UNESCO soil map of the world; (b) estimation of available arable lands for the major FAO study "Agriculture Towards 2010"; (c) analysis of the suitability of inland aquaculture sites of Africa and South and Central America for fish-farming potential; (d) soil suitability analysis studies for various crops in Africa; (e) potential food self-sufficiency at high- and low-input levels; (f) a dominant land resource map for Africa; (g) a nutrition profiles map; (h) fish distribution maps for the Mediterranean; and (i) World Food Summit support maps. Remote sensing and GIS technology are also being used for food insecurity, vulnerability and poverty mapping by FAO in cooperation with several other agencies. A substantial programme for poverty mapping using GIS technology, supported by the Government of Norway, is expected to become operational in 2000, as a cooperative activity between FAO, GRID-Arendal and the International Centre for Tropical Agriculture under the aegis of the multi-agency Food Insecurity and Vulnerability Information and Mapping System (FIVIMS) Programme.

91. FAO envisages the increasing use of Global Positioning Systems (GPS) in surveys and the integration of remote sensing data into GIS-based land resource information systems. FAO is considering using remote sensing to assess and monitor the progress of soil and water conservation works carried out in the field within the framework of national programmes assisted by the World Food Programme (WFP).

92. Within the framework of the MAB programme, UNESCO will continue to cooperate with the Sahara and Sahel Observatory (OSS) in the creation of an ecological observatory network, called ROSELT, in Africa. UNESCO will assist in particular in introducing the use of space technology for environmental monitoring.

93. UNESCO, ICSU and several ICSU affiliates are sponsors of the Diversitas Programme on biodiversity science. The year 2001 has been declared the International Biodiversity Observation Year, for which a number of activities are being promoted worldwide, many of which use remote sensing technologies and GIS applications.

94. The Division of Earth Sciences of UNESCO will continue to implement the joint UNESCO/International Union of Geological Sciences (IUGS) GARS programme in 2000, 2001 and beyond as follows:

(a) Third phase of the GARS-Africa project concerning the development of a regional remote sensing user network in Africa in cooperation with the Royal Museum of Central Africa (MRAC) of Belgium. This activity is linked with the Pan-African Network for a Geological Information System (PANGIS) project, to which remote sensing data interpretation capabilities have been added. The International Centre for Training and Exchanges in Geosciences (CIFEG) of France and MRAC cooperate with UNESCO in the PANGIS project, which currently has 33 African member countries;

(b) Final phase of the GARS-Latin America project, which focuses on mountain hazard and landslide mapping of the Andean subregion using microwave space-borne sensor data and GIS technology;

(c) Operational phase of the GARS-Asia project, which focuses on the development of a new methodology for volcanic hazard assessment and prediction using multisatellite data and GIS technology. Four volcanic test sites in the Philippines are being monitored in this project, namely Bulusan, Mayon, Pinatubo and Taal volcanoes;

(d) The research results of the different GARS projects will be presented at specialized symposia taking place during the International Geological Congress, Brazil, August 2000.

95. UNESCO cooperates with the Council of Europe, the European Commission and ESA in implementing the "Space techniques for major risks management" (STRIM) programme.

96. UNESCO and UNDP are implementing the "Sustainable Development of the South Valley and Sinai" programme using remote sensing and GIS technologies. This three-year programme is being carried out in collaboration with the Geological Survey of Egypt and the Egyptian National Authority for Remote Sensing.

97. The UNESCO World Heritage Centre is exploring possibilities with the NASA Earth Studies Unit concerning the use of archived and new satellite and remote sensing images for the study of land-cover changes in and around the Dja Faunal Reserve in Cameroon, with a view to

assessing the extent of the threat of biological isolation facing this site, and for the study of land-cover dynamics of 35 natural world heritage sites in tropical regions. The results of discussions will be known in early 2000.

98. The UNESCO World Heritage Centre is also developing with ESA a modern information management system for the monitoring of cultural and historical sites.

99. Within the framework of its Space Archaeology Programme, UNESCO will continue to develop cooperation with space agencies, such as NASA of the United States, the National Space Development Agency of Japan and the Centre national d'études spatiales (CNES) of France, for the implementation of field research activities such as prospecting archaeological sites and study of archaeological sites in their geographical environment.

3. Dissemination or exchange of information on the status of technology or operational systems through meetings or publications and/or policy coordination

Dissemination of technological information

100. UNEP, through UNEP/EAP.AP-Bangkok, distributes copies of the Asia Pacific Mosaic based on 1993 NOAA-AVHRR high-resolution picture transmission data obtained from USGS-EDC, the National Environmental Satellite, Data and Information Service (NESDIS) of NOAA, the National Research Council of Thailand, the State Meteorological Administration/Satellite Meteorology Centre (SMA/SMC) of China, GRID-Tsukuba, the Centre for Environmental Remote Sensing (CEReS) of Japan and Chiba University in Japan. In addition, an IRS WiFS mosaic for Cambodia, northern India, Myanmar, Thailand and the Lao People's Democratic Republic.

101. UNEP, through GRID-Sioux Falls, completed a number of publications relating to the integration of Earth observation and socio-economic data to address environment and development interactions, including the following, which are being distributed:

(a) An analytical report entitled "Early warning of selected environmental issues in Africa" with the assistance of three scientists from Ghana, Senegal and Uganda, which revealed new findings about environmental issues in Africa;

(b) A paper entitled "Application of geo-spatial information for identifying priority areas for biodiversity conservation in Africa" in the book *Nature and Human Society: the Quest for a Sustainable World* of the United States National Academy of Sciences (in press);

(c) A paper entitled "Assessing environmental conditions of major river basins in Africa as a surrogate for watershed health" for the *Journal of Ecosystem Health* (in press);

(d) A report on "Satellite Earth observation in wildfire management", as co-chair of the CEOS Disaster Management Support Project.

102. UNEP/EAP.AP-Bangkok has prepared a new publication on land use/land-cover change in south-east Asia, which is being distributed free of charge. A compact disc containing data and publications relating to land-cover projects is being prepared and will be available in the first quarter of 2000.

103. UNEP, through GRID-Sioux Falls, will continue to disseminate information related to the latest developments in information technology, including remote sensing, GIS data management and applications and Internet technologies.

104. UNEP, through GRID-Sioux Falls, is pioneering the use of interactive Internet Map Server (IMS) technology within the United Nations system that would allow users to specify data and the scale of maps in cooperation with the Environmental Systems Research Institute (ESRI). In this connection, UNEP, through GRID-Sioux Falls, is completing the Global Energy and Water Cycle Experiment (GEWEX) project with advanced Internet data access capability and is implementing a compliant clearinghouse node for UNEP data that is compliant with International Organization for Standardization (ISO)/Federal Geographic Data Committee of USGS standards.

105. In 2000 and 2001, UNEP will strive to make more of its published and database materials available on the Internet and the World Wide Web. Over a million freely available files have been transferred over the past years from the award-winning Internet site of GRID-Sioux Falls. UNEP will continue to promote such access to important data and information.

106. In the period 2000 and 2001, ECA will continue enhancing its efforts to use electronic media for the dissemination of information and results of studies on geo-information in development.

107. ECA will further consolidate the contents of the database on geo-information in Africa, which includes GIS

applications, mapping coverage and educational training facilities.

108. The Statistical Division of ECE will organize a work session on methodological issues involving the integration of statistics and geography in Neuchatel, Switzerland, from 10 to 12 April 2000. In close cooperation with the Statistical Office of the European Communities (Eurostat) and the Statistical Division of the Secretariat, the meeting is being organized as an activity under programme element 2.6—geographical and regional data of the programme of work of the Conference of European Statisticians. The following topics will be discussed at the meeting: (a) spatial database management and (geo)data warehousing; (b) Internet and Intranet solutions; (c) policy and organizational aspects of GIS and statistics; and (d) spatial analysis in a statistical context and disclosure control procedures.

109. ESCAP will continue to publish the annual *Asian-Pacific Remote Sensing and GIS Journal* in 2000 and 2001.

110. ESCAP will prepare and disseminate publications and reports on pilot projects conducted under the Regional Space Applications Programme for Sustainable Development, as a part of its regular information service activities in 2000 and 2001.

111. The ESCAP Regional Working Group on Remote Sensing, Geographic Information System and Satellite-based Positioning will continue to update its homepage on the Internet.

112. To assist in the dissemination of information on remote sensing and GIS technology applications, FAO produces technical publications relating to land-cover classification systems, environmental indicators, coastal management guidelines and agro-climatological databases. FAO also regularly produces, in cooperation with national remote sensing institutions, the "Remote Sensing for Decision-Making" series in various languages for worldwide distribution.

113. FAO maintains a web site on desertification (http://www.fao.org/desertification/), which contains, among many other modules, a global geo-reference database on parameters related to desertification. This database, in combination with other activities of FAO related to information systems on desertification, may be extended progressively to form a technical support service for national and regional organizations and programmes in implementing the Convention to Combat Desertification, depending on availability of external funding resources. FAO has also offered its technical support to the recently launched Asian Convention to Combat Desertification thematic network, called "TPN1" on desertification assessment and monitoring.

Elaboration of strategies or plans for future applications programmes or systems and/or policy coordination

114. During 2000 and 2001, ECA will organize the following:

(a) An ad hoc expert group meeting to discuss the orientation of GIS in Africa, to be held in June 2000.

(b) The meeting of the Subcommittee on Geo-information, which will report to the Committee on Development Information in early 2001.

115. ESCAP will hold the annual meeting of the Regional Working Group on Remote Sensing, Geographic Information System and Satellite-based Positioning at Tehran, Islamic Republic of Iran, in July 2000. The venue of the annual meeting in 2001 is to be determined.

116. ESCAP will conduct consultative meetings to arrange for regional remote sensing and GIS activities during 2000 and 2001.

117. FAO will continue to develop active partnerships with the European Union, JRC, NASA, NOAA, EUMETSAT and ESA, as well as other space agencies, on the development and operational use of new data sources with a view to improving its information services and to broaden the group of users, both at FAO Headquarters and in the field.

118. FAO participates in international meetings on the use of information systems within the framework of the United Nations Convention to Combat Desertification, and prepared, at the request of the Executive Secretary of the Convention to Combat Desertification, a concept paper on the design of a new important global initiative called the Overall Assessment of Desertification (OAD).

119. FAO has approved a long-term strategic framework for 2000-2015. Among five corporate strategies proposed for the FAO strategic framework, one clearly emphasizes improving data availability and information exchange; monitoring, assessing and analysing the global state of food and nutrition, agriculture, fisheries and forestry; and promoting a central place for food security in the international agenda. A priority of the strategy is that a comprehensive, current and reliable set of data be disse-

minated to all Members and accessible to the international community and the public at large. The November 1999 FAO Conference endorsed the strategic framework and emphasized the importance of the information strategy.

120. UNESCO will support the Third Symposium on Information for Sustainable Development of the African Association of Remote Sensing of the Environment, Cape Town, South Africa, March 2000.

4. Capacity-building

121. The UNEP Division of Environmental Information, Assessment and Early Warning (DEIA&EW) has been further restructured along functional lines to include an Assessment and Reporting Branch; an Environmental Networking and Information Frameworks Branch; and Environmental Information Services (EIS). The Networking Branch encompasses the GRID network, data and information management in support of assessment and regional capacity-building activities (ENRIN programme) at the institutional level, whereas the EIS deals with communications, dissemination and exchange of scientific and technical environmental information, as well as UNEPnet (see paragraph 154 below) and the Global Environmental Information Exchange Network (INFOTERRA) (see paragraph 160 below), and is responsible for maintenance of the Mercure system.

122. UNEP capacity-building activities are restricted to those institutions that are active in expanding their data and information assessment network serviced by GRID and ENRIN. UNEP network capacity-building and servicing activities are aimed, as appropriate, at identifying the needs of partner institutions, designing projects and formulating proposals to meet those needs and assisting the institutions in mobilizing resources to implement the projects. In return, UNEP seeks to enter into agreements on data access and exchange in the service of international assessment and reporting.

123. In Africa, UNEP continues to build networks and serve as a catalytic force for capacity-building within the framework of the ENRIN project, with the support of GRID-Nairobi. A dialogue is ongoing with the Intergovernmental Authority on Development (IGAD) on a network strategy for the IGAD countries.

124. UNEP maintains cooperation with the Southern African Development Community (SADC) in the development of networks to support environmental and land management in the region. A joint SADC/UNEP-ENRIN initiative is aimed at strengthening national and subregional institutional capacities for environmental data and information management to support decision-making processes. The initiative comprises the following two components: SADC Regional Database Development and Networking, implemented by the SADC Food Security Technical and Administration Unit for the SADC Environment and Land Management Sector (ELMS); and EIS Training and Education, providing SADC and member States with necessary support to establish and strengthen in-country EIS training and education infrastructure to meet the growing demand for skills in the specialized areas of environmental assessment and reporting as well as environmental data and information management.

125. UNEP is working on a similar initiative for the subregional organization of the Permanent Interstate Committee for Drought Control in the Sahel. UNEP, in collaboration with the AGRHYMET Centre, elaborated a Regional EIS and Networking Implementation Strategy, focusing on the following four strategic areas: institutional capacities; information exchange networks; harmonization and standardization of data and assessment and monitoring tools, including those for national and regional reporting on the state of the environment; and in-country training capacities.

126. UNEP continues to provide technical backstopping assistance to Eritrea, Ghana, Kenya, Lesotho, Uganda, the United Republic of Tanzania and Zambia. Continuing cooperation in the development of environmental information systems in Africa is coordinated through the Advisory Committee on Environmental Information Systems in Sub-Saharan Africa. Sponsored by the World Bank, UNEP, UNDP/Office to Combat Desertification and Drought, Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation), USAID and the Norwegian Agency for International Development, the Advisory Committee provides a forum for coordination and the exchange of ideas.

127. UNEP also cooperates with the FAO Regional Office for Africa, at Accra, in strengthening institutional capacities for developing coastal and marine environmental databases for some countries along the west African coast, such as Gambia, Ghana and Guinea. UNEP and its EIS Programme in sub-Saharan Africa also cooperate with countries in west Africa to develop guidelines for data standards and harmonization to facilitate the exchange and use of information within the region.

128. UNEP continues to develop data access agreements in Asia and the Pacific with cooperating institutions in the Association of South-East Asian Nations (ASEAN), the Mekong River Commission, ICIMOD, the South Asia Cooperative Environment Programme, at Colombo, and the South Pacific Regional Environment Programme, as well as other small intergovernmental organizations. Regular meetings are held with the principal partners to ensure that the agreement will take a complementary approach to capacity-building for assessment and reporting, including data management. Cooperation is continuing with the ESCAP Statistics and Natural Resources Division, the UNDP Regional Office for Asia and the Pacific, the Asian Disaster Preparedness Centre, ICIMOD, the International Crop Research Institute for the Semi-Arid Tropics and the International Rice Research Institute.

129. The UNEP/ENRIN programme for the Commonwealth of Independent States (CIS), Central and Eastern European countries (CCEE) with economies in transition continues through GRID-Arendal. Three new project proposals on needs assessment and capacity-building have been formulated for the region, and a new GRID centre was opened within the Ministry of the Environment at Tbilisi. Following the completion of the pilot phase for the development of a GRID centre in the Russian Federation, GRID-Moscow, at the Federal Centre for Geo-Ecological Systems of the State Committee for Environmental Protection, a new memorandum of understanding for the continuation of GRID-Moscow is to be developed in the year 2000.

130. UNEP continues to place strong emphasis on inter-agency cooperation at all levels in the CCEE region, particularly with UNHCR, UNITAR, ECE, UNDP, the WHO European Centre for Environment and Health, the World Bank, the Regional Environmental Centre at Budapest, the Organisation for Economic Cooperation and Development (OECD), the European Environment Agency, GEF, the Phare programme of the European Union, Community Programme of Technical Assistance for CIS countries (TACIS) and WCMC.

131. Since mid-1999, GRID-Geneva has been investigating the feasibility of a project on eastern Mediterranean capacity-building, jointly with the Centre for Environment and Development for the Arab Region and Europe (CEDARE), based in Cairo. The project aims to map marine pollution from land-based sources in Lebanon using remote sensing techniques. After a July 1999 mission to Lebanon, the project's objectives were extended to the establishment of a general coastal information system. Potential partners of the project include the Lebanese Council for Development and Reconstruction (CDR), the National Centre for Remote Sensing (NCRS) and the Ministry of Environment of Lebanon, as well as UNEP-MAP in Athens. The project will also be linked with the soon-to-be-established Lebanese Environment and Development Observatory (LEDO) within the Ministry of Environment, which has been organized by UNEP/MAP and others.

132. UNEP, through GRID-Geneva and the MAP/Blue Plan office at Sophia Antipolis, France, has been preparing a new strategy for ENRIN capacity-building in the Mediterranean region. Since 1995, the MAP/Blue Plan office has been developing a series of environmental "observatories" in several Mediterranean countries which, like national GRID centres, have the capacity to collect, manage, analyse and distribute various types of environmental and socio-economic data sets and information. UNEP plans to support this effort with the technical capacity of GRID and the extension of ENRIN programme activities to the Mediterranean through the development of new proposals for donor and partnership funding.

133. Subject to the availability of finances, UNEP will continue to seek opportunities to offer short-term fellowships to appropriate persons from developing countries to work at GRID-Sioux Falls and to develop or analyse data sets relating to environmental issues in their home countries. In 1999, fellowships were offered to scientists from China, Ghana, Senegal and Uganda.

134. ESCAP will continue to organize regional seminars on Earth observation for natural resource management, environmental monitoring and natural disaster mitigation, which aim to build national capacity in using remote sensing and GIS to contribute to sustainable environmental and natural resource management in the Asian and Pacific region.

135. Phase II of the FAO Regional Remote Sensing Project (RRSP) for the member States of SADC resulted in the establishment of the SADC Regional Remote Sensing Unit (RRSU) with an advanced capacity for handling and analysis of ARTEMIS and other environmental databases, direct reception and processing of Meteosat data and communication of various information products by electronic means to the SADC regional and national early warning systems, as well as to other users. A follow-up project for consolidating and strengthening of the technical and institutional capacity for satellite-based environmental

monitoring of SADC to support early warning systems for food security and forecasting of agricultural and rangeland production has been approved for funding by the European Union and is scheduled to become operational in January 2000 for a period of three years. This project is designed to develop and implement food-security-related environmental monitoring activities at regional, national and subnational levels. It will be implemented by FAO in cooperation with SADC Food and Natural Resources (FANR) Sector Unit and concerned SADC government agencies, also involving non-governmental organizations and the private sector.

136. A similar FAO regional project for the countries in the eastern Africa region resulted in fully operational capacity in the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) for processingMeteosat and NOAA-AVHRR Global Area Coverage/Local Area Coverage data and generating information products, including the preparation of food-security early warning bulletins for the countries of the IGAD region. Another similar project for west and central Africa has also been formulated and is currently being reviewed for possible funding by the Government of Belgium.

137. With support from UNDP, FAO has developed a Programme Management Information System (ProMIS) for Afghanistan with the objective of supporting the assistance efforts of organizations within the United Nations system, donors to non-governmental organizations and Afghan institutions in coordination, planning and implementation, enhanced monitoring and evaluation of humanitarian, emergency and development efforts. The primary objectives of ProMIS are: (a) to make data and documents broadly accessible and easily usable; (b) to provide tools for translating geographic and spreadsheet data into information products; (c) to assist organizations in capitalizing on investment in data and information; (d) to support the implementation of current and new management systems; and (e) to facilitate monitoring and evaluation of new Afghan assistance programmes. ProMIS development was started in 1997 and is currently continuing.

138. FAO cooperates with the regional commissions of the United Nations and regional and national remote sensing centres and environmental agencies in the development and efficient use of remote sensing and GIS technology for mapping, assessment and monitoring of renewable natural resources, studies of land resource dynamics and monitoring of natural disaster. Priorities have been reoriented to focus on capacity-building for the implementation of the recommendations of Agenda 21 of the United Nations Conference on Environment and Development and the recommendations of the World Food Summit, held in Rome in November 1996, as well as the international conventions on desertification, biodiversity and climate change, including the Kyoto Protocol.

139. UNESCO will assist the Government of the Libyan Arab Jamahiriya, through the organization of specialized workshops, in strengthening the country's remote sensing and GIS infrastructure to improve the study of its natural resources.

140. UNESCO started implementing in late 1999 a four-year project funded by the Government of Netherlands aimed at strengthening the capacity of central American countries to mitigate the effects of natural disasters. The project's activities include training and hands-on experience in geo-hazard zonation and vulnerability assessment and risk mapping using GIS technology. UNESCO cooperates closely with the Centre for Coordination of the Prevention of Natural Disasters in Central America (CEPREDENAC) and with ITC, Delft Technical University and the University of Utrecht, as well as with the GeoForschungs Zentrum Potsdam of Germany and the Bureau de Recherches Géologiques et Minières (BRGM) of France.

B. Communications and navigation

1. Education and training programmes

Training courses, workshops and seminars

141. ECA, in collaboration with its partners, will organize group training workshops in member States on developing national information and communications infrastructure policies, plans and strategies with two workshops per year in the years 2000 and 2001.

142. ESCAP is currently developing a proposal to hold in 2000 a regional seminar on the use and potential of high data rate communication satellites such as the Gigabit and ETS VIII satellites in community teleservice centre projects.

143. ICAO is conducting activities to face new challenges concerning human resources involved in the introduction of advanced satellite-based communications, navigation and surveillance and air traffic management (CNS/ATM). ICAO addresses human resource planning and training

issues through its TRAINAIR programme, which provides a mechanism for cooperation among training centres for the development of the many new training courses that are required to support the introduction of CNS/ATM. During 1999, seminars on the implementation of GNSS were organized by ICAO for the Asian and Pacific, Caribbean and South American regions. Similar seminars will continue to be organized in the future.

144. The ITU Radiocommunication Bureau (BR) will be organizing world seminars every two years and regional seminars in the intervening years on frequency management, the use of the geostationary orbit and preparatory activities for the radiocommunication conferences with a view to providing technical assistance to the participating countries.

145. The ITU Telecommunications Development Bureau (BDT) conducts, within the Valletta Action Plan for Global Telecommunications Development, round tables and seminars on telecommunication policies, strategies, research and development for developing countries, training of staff from developing countries in various areas of telecommunications, use of GMDSS and mobile satellite communications, in particular global personal communications by satellite (GMPCS).

146. ITU has four projects for the establishment of centres of excellence in telecommunications: two in Africa, one in Asia and one in the Americas. The centres will play an important role in strengthening competencies in the field of telecommunications by the different levels of management in the areas of policy, regulatory activity, management (frequency management) and technology.

Fellowships

147. The United Nations Programme on Space Applications and ESA are working together on a reorientation of the fellowships programmes for research and study on space antennas and electromagnetics, and on communications systems available at the European Space Research and Technology Centre at Noordwijk, Netherlands.

148. ITU continues to provide fellowship support for candidates from developing countries to participate in its meetings.

2. Expert services and survey missions to identify specific areas of applications relevant to a given country or group of countries and to carry out specific studies on pilot projects or to implement the projects with operational applications of technology

Provision of expert services and survey missions

149. In 2000-2001, the Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, will continue to provide technical advisory services to the secretariat of the Asia-Pacific Satellite Communications Council.

150. ECA provides advisory services to its member States, subregional and regional institutions on developing information and communications infrastructure, policies, plans and strategies (two missions per year).

151. UNESCO will assist the Government of the Libyan Arab Jamahiriya in developing distance learning education programmes for higher education.

152. Activities of ITU in the area of satellite communications include the following:

(a) At the request of administrations of member States that are developing countries, BDT will continue to provide experts to participate in satellite Earth station projects and in the planning of regional or domestic satellite communication systems. Documents prepared by BDT, such as the telecommunication development plans, master plans or sectoral studies, usually include a satellite component;

(b) Administrations of member States will continue to be kept informed on a regular basis, through the fortnightly information circulars of BR and its special sections annexed thereto, now published on CD-ROM, of the basic technical characteristics, frequency assignments and orbital positions of space systems communicated to the Bureau. This information is also made available on the Internet.

Studies, pilot projects and operational applications

153. UNEP operates Mercure, a satellite-based telecommunications system operating through the International Telecommunications Satellite Organization (INTELSAT). Mercure is designed to improve global access to environmental information and provides key infrastructure for the UNEP environmental information Internet, UNEPnet (see

A/AC.105/700, para. 181). It uses INTELSAT satellites in geosynchronous orbit over the Indian and Atlantic oceans. High-capacity Earth stations operate at: Beijing, China; San José, Costa Rica; Nairobi, Kenya; Arendal, Norway; Geneva, Switzerland; and Bangkok, Thailand. These stations will serve information management needs of national and regional environment authorities and UNEP headquarters and regional offices. Lower-capacity stations to meet the information management needs of national environment agencies have been established in: Vienna, Austria; Manama, Bahrain; La Paz, Bolivia; Havana, Cuba; Almaty, Kazakhstan; Maputo, Mozambique; Katmandu, Nepal; Niamey, Niger; and Hanoi, Viet Nam.

154. Consistent with the objectives of chapter 40 of Agenda 21, UNEP also operates UNEPnet, an international environmental Internet targeted at meeting the information management needs of UNEP partners and users of environmental information worldwide. Mercure ensures the viability of UNEPnet in developing countries and in countries with economies in transition by providing satellite telecommunications for global delivery of environmental information products. Modern and cost-effective data communications through UNEPnet and its links to the global Internet provide access to comprehensive information on the environment and sustainable development. UNEPnet supports the UNEP Intranet system with connections to national focal points.

155. The space-based telecommunications of UNEPnet and Mercure are providing invaluable support and cost-effectiveness to the operations of UNEP as a United Nations entity. One area is videoconferencing. UNEPnet/Mercure now supports digital telephony services of the integrated services digital network (ISDN) to all United Nations agencies located at the Gigiri campus in Nairobi. As a result, videoconference services from the desktop are now feasible. These services not only supplant previous demands for missions but also facilitate regular brief interactions, such as the Executive Director's participation in weekly high-level management sessions with his peers. Similar videoconference services are now being implemented at UNEP regional and outposted offices on six continents.

156. UNEPnet/Mercure satellite services also provide a number of cost-effective services that reduce telecommunications costs of UNEP. Particular areas of interest are Internet-based services for telephony and fax. Cost savings in the order of $100,000 per month are now feasible. Similar services are also being extended to UNEP regional and outposted offices on six continents.

157. UNEPnet/Mercure is participating in the work of CEOS. UNEP serves as the User Vice-chair of the CEOS Working Group on Information Systems and Services (WGISS). IOC of UNESCO also cooperates closely with CEOS in the activities of WGISS.

158. As an associate member of CEOS, and under the umbrella of the CEOS virtual network, UNEP is negotiating with peer networks to further extend environmental information services provided by UNEPnet/Mercure. Examples include initiatives through ESCAP to gain access to the Asia-Pacific Advanced Network (APAN) and the Global Observation Information Network (GOIN). Environmental satellite telecommunications can be extended to the small island developing States of the Pacific, in particular to the member States of the South Pacific Regional Environment Programme (SPREP). In implementing their responsibilities under the international environmental conventions, these countries are confronted with huge financial and logistical constraints in regional communications. UNEPnet/Mercure can offer access to remotely sensed data for management of marine resources and for environmental legislation. Other opportunities include service to Mongolia for the validation and calibration of data from orbital sensors.

159. UNEPnet/Mercure also provides a number of CEOS-related information services intended to increase environmental applications of Earth observation data. UNEP hosts sites of the CEOS International Directory Network (IDN) in Hungary, Kenya and Switzerland. UNEP is also adopting the CEOS Information Locator System (CILS) as a core item of its information servicing infrastructure. UNEP will in future be working to implement gateways for the Catalogue Interoperability Protocol (CIP). IDN, CILS and CIP are all outcomes of WGISS. Furthermore, UNEP is very active in CEOS-based activities relating to metadata for spatial data, including Earth observation data sets. UNEP now represents CEOS/WGISS in the technical committee on spatial metadata of ISO.

160. UNEP will continue to promote the exchange of data and other information through INFOTERRA, which now has national focal points in 175 countries. INFOTERRA supports a number of clearing-house mechanisms and maintains a subscription list for environmental queries and a Gopher node on the Internet. UNEP continues to promote telecommunications methods, including satellite-based communication and other methods to exchange environ-

mental information for the above-mentioned purposes. INFOTERRA released a new version of its environmental thesaurus, Envoc, which is used as a basis for all UNEP database terminology.

161. During 2000 and 2001, ECA will carry out the following studies and will disseminate publications concerning the results of the studies:

(a) A study on the status of information and communications technologies in Africa (third quarter, 2000);

(b) A study on the impact of the Information Society Initiative in Africa (third quarter, 2001);

(c) A study on building the information economy in Africa (second quarter, 2001).

162. In 2000 and 2001, ECA will continue, in collaboration with its partners, field projects to implement the African Information Society Initiative.

163. ESCAP is currently developing a study project on the use of high-speed communications satellites for multimedia applications in community teleservice centres, for implementation in 2000 and 2001.

164. ESCAP is currently developing a pilot project on integrated rural capacity-building through development and applications of the satellite-based community teleservice centre concept, for implementation in 2000 and 2002.

165. FAO is involved in helping member countries strengthen their capacity to develop distance learning programmes, using various means including satellite communications systems. Through its Extension, Education and Communication Service (SDRE), FAO provides technical advice to member countries in establishing distance education centres and developing course programmes. The activities target specific interested groups such as farmers, farm workers and managers, extension workers, teachers, other government agriculture and rural development workers, agriculturally related clientele of non-governmental organizations and the private sector. Such activities have benefited member countries such as China, through a project on the Agriculture and Rural TV Broadcast Education Center, and Zimbabwe, through the Zimbabwe Open University (ZOU) project.

166. UNESCO is continuing to examine different ways and means of making wider use of low- and geostationary-orbit satellite systems for communication, information, informatics, education, science, culture and environmental protection in the implementation of programmes and projects such as the following:

(a) Within the framework of the recovery plan and privatization of the Pan-African News Agency, the African Network for Integration and Development (RAPIDE) is being established. RAPIDE is aimed at ensuring the strong presence of Africa on the economic, scientific, social and cultural fronts on the Internet, which will therefore be used as a catalyst for the economic development of the continent. On the technical front, RAPIDE will use the connecting facilities offered by the International Society of Aeronautical Telecommunications (SITA);

(b) Within the framework of the International Commission on Education for the Twenty-first Century (Delors Commission), UNESCO will continue to assess, evaluate and study the experience achieved in distance education as well as the impact of new communication and information technologies, in particular communication satellites useful for distance education.

167. UNESCO is presently exploring the operational use of the "Slavyanka" telecommunications station for its programmes' activities. This station, which is operated by a Russian satellite ("Horizon" type) and installed at UNESCO headquarters, can be used for distance education and videoconferencing and can access the Internet. A test of a videoconferencing link with the UNESCO Institute for Information Technologies in Moscow was successfully conducted in 1999.

168. UNESCO participates in the Trans-European Teleeducation Network initiated by the European Commission aimed at creating a European distance training network. UNESCO cooperates with the Czech Republic, Hungary, Lithuania and Poland.

169. UNESCO is developing with ESA a telemedicine project in Palestine that aims at strengthening Palestine's distance learning capabilities with respect to medical education.

170. UNESCO is assisting the International Organization for Statistical Studies on Oesophagus Diseases in developing telemedicine projects on information validation and exchange and distance learning.

171. Within the framework of the UNESCO initiative "Learning without frontiers", which fosters lifelong education for all at all levels, joint ITU/UNESCO pilot projects on education applications of interactive television are being implemented. The project, which supports the teaching of primary teachers in developing countries,

consists of providing sound and visual images to the "virtual classrooms". The return path enables the viewer to communicate by voice and data channels with the broadcast site. While UNESCO will be responsible for the conceptual aspects and educational content, ITU, which is developing the standards, will take primary responsibility for the technical implementation and choice of technological solutions.

172. Within the framework of the UNESCO/ITU Co-operation Agreement, UNESCO participates in the implementation of the Valletta Action Plan of the Second World Telecommunication Development Conference (WTDC) (Valletta 1998) and contributes to the activities of established Working Groups I and II.

173. The second WTDC, held at Valletta from 23 March to 1 April 1998, analysed the implementation of the Buenos Aires Action Plan, adopted by WTDC in 1994, and incorporated it into the Valletta Action Plan for the period 1999 to 2003. The Valletta Action Plan includes a number of projects, one of them concerning the introduction of new technologies and new services for developing countries. Under the project, a number of seminars and workshops will be organized on the following subjects: (a) GMPCS; (b) technological convergence; (c) digital audio and video broadcasting; (d) spectrum management; and (e) telemedicine, tele-education and other services. The Conference reviewed the execution of the SPACECOM project and updated the programme for its further development. The Conference also adopted a work plan for the development of a long-term strategy for the future use of the frequency spectrum in developing countries.

174. ITU will continue to contribute in this sphere through the following activities:

(a) In the light of technological development, ITU radiocommunication study groups 1, 3, 4, 7, 8, 10 and 11 will pursue studies on technology and spectrum/orbit utilization for space communications. The radiocommunication study groups are part of the ITU Radiocommunication Sector (ITU-R), which is responsible for studying technical, operational and regulatory/procedural questions on radiocommunication, issuing recommendations and preparing the technical basis for radiocommunication assemblies and world radiocommunication conferences. In particular, ITU-R has established standards for the detailed specifications of the radio interfaces of International Mobile Telecommunication-2000 (IMT-2000), the satellite component of which is comprised of six different interfaces;

(b) The Telecommunication Standardization Bureau of ITU has been studying technical, operational and tariff questions and adopting recommendations on them with a view to standardizing telecommunications on a worldwide basis. The priority for the Bureau is the elaboration of standards for the implementation of the Global Information Infrastructure and global multimedia mobility. The Bureau will continue its studies in the application of space technology in different services, such as aeronautical, maritime and land mobile telecommunication services to remote regions and for weather forecasts. The Bureau will also continue to ensure the full integration of the satellite transmission medium in worldwide telecommunications networks;

(c) The intersectoral groups of ITU-R and the Telecommunication Standardization Bureau ensure that studies carried out in the two sectors are conducted in a harmonized way, avoiding any possible overlapping and dispersion of efforts. The intersectoral group on satellite matters reviews the recommendations of the two sectors in order to ensure the full integration of the satellite transmission medium in the telecommunication networks, taking into account emerging technology, applications and services;

(d) BDT has completed the implementation of the Buenos Aires Action Plan and is now implementing the Valletta Action Plan adopted by the Second WTDC. The Valletta Action Plan comprises three chapters:

(i) Chapter I. Programme of cooperation among the members in the Telecommunication Development Sector;

(ii) Chapter II. Valletta Action Plan Programmes, including the following: programme 1 on reform, legislation and regulation of telecommunications; programme 2 on technologies and global information infrastructure (GII) development and applications, including GMPCS and Internet; programme 3 on rural development and universal service/access; programme 4 on finance and economics, including WTO issues, tariffs, accounting rates etc; programme 5 on development partnership with the private sector; and programme 6 on capacity-building through human resources development and management;

(iii) Chapter III. Special programme for least developed countries.

The Valletta Action Plan refers to coordinated regional and global activities complemented by multilateral and

bilateral projects executed or supported by ITU and its development partners;

(e) Within the framework of the Buenos Aires Action Plan for Global Telecommunication Development, which listed as a priority item the need to increase the accessibility of telecommunication services in rural and remote areas in developing countries, ITU launched in 1994 an interregional project for developing countries, SPACECOM. The project was designed by BDT, in association with industry. The project seeks to promote the broad applications of space communications technology in developing countries, which would greatly contribute to the development of the countries concerned and the satellite communication industry by forging a strong partnership between the space communications industry and the telecommunication operator and user community in developing countries. Satellite communication technology may well provide a low-cost means of establishing various types of telecommunication services (telephony, video, data) anywhere in the world, but many obstacles still stand in the way of its application in developing countries.

175. Although the involvement of ITU in the Regional African Satellite Communications System project formally terminated in December 1993, ITU is following its activities and coordinating with the Pan-African Telecommunications Network, since the two systems (satellite and terrestrial) are complementary (A/AC.105/551, paras. 151 and 152). In particular, rural and remote areas will have to be linked to the networks through either of the above systems.

176. ITU will participate in the pilot projects initiated by Tunisia, entitled "Establishment of a terrestrial and space telecommunications infrastructure for an integrated information system on the environment and sustainable development in Tunisia" and "Establishment of a satellite-based network for the remote monitoring of sea-water quality". ITU will also participate in a project undertaken by Benin, entitled "Pilot project for natural disaster warning system".

3. Dissemination or exchange of information on the status of technology or operational systems through meetings or publications and/or policy coordination

Dissemination of technological information

177. In the year 2000, ECA will produce and disseminate "Africa CD 2000", with information on development activities in Africa.

178. ESCAP will prepare and disseminate publications and reports on: pilot projects, subject to their approval for implementation; the regional seminar on the use and potential of high-speed communications satellites for community teleservice centre project applications in 2000; and the study project on the use of high-speed communications satellites for multimedia applications in community teleservice centres in 2002.

179. The ESCAP Regional Working Group on Satellite Communication Applications will continue to update its homepage on the Internet.

180. ITU will continue to contribute in this sphere through the following activities:

(a) BR periodically publishes approved recommendations, either new or revised, on space radiocommunications. Publications of special interest for space radiocommunications concern issues on space applications; fixed-satellite, mobile-satellite, radio determination-satellite, amateur-satellite and broadcasting-satellite (sound and television) services; satellite news-gathering; frequency sharing; and compatibility of different services. They form the basis for harmonious technical development of space radiocommunication systems and contain criteria for the sharing of frequency bands between the various space services, as well as between space and terrestrial systems;

(b) The third edition of the ITU *Handbook on Satellite Communications (Fixed-Satellite Service)*, the *Handbook on the Mobile-Satellite Service* and the *Handbook on Broadcasting Satellite Systems* are under preparation and are expected to be published during the year 2000;

(c) BR publishes a quarterly updated list of orbital positions and associated frequency bands of space stations on board geostationary satellites and non-geostationary space systems. An improved list is under development. This will be updated on a daily basis and will be available early in 2000 via the Internet. In more detailed form, BR

publishes, on CD-ROM, all the technical characteristics of satellite networks submitted to it under the coordination or notification procedures, for recording in the Master International Frequency Register. The information is also available on Internet;

(d) BDT issued in 1998 the report of the Group of Experts established by the Director of BDT in accordance with Opinion 5 of the 1996 World Telecommunication Policy Forum (WTPF). This report analyses the list of factors that should be taken into account for introducing GMPCS services;

(e) BDT will publish in 2000, in collaboration with the GMPCS operators and industry, a reference book compiling basic technical, operational, regulatory and socio-economic information related to the introduction of GMPCS technology and services in the world in general and in developing countries in particular. This work is part of BDT assistance to the developing countries in apprehending and optimizing the use of and benefits from GMPCS, which is the latest space telecommunication application technology.

Elaboration of strategies or plans for future applications programmes or systems and/or policy coordination

181. ECA will organize an ad hoc expert group meeting on the African Information Society Initiative in September 2000.

182. Increasingly involved in information and communications technology applications, FAO is progressively moving to the digital age by developing a World Agricultural Information Centre (WAICENT) and various corporate digital spatial databases, including various environmental decision-support tools. Through worldwide networking, FAO aims to expand the reach of its services to help member States to design and implement national and regional policies and strategies for using new and emerging space technology and applications for sustainable agricultural development. A digital FAO will doubtlessly improve the accessibility of data and information for decision-making and create awareness among various end-users and cooperation with international organizations, national governments and the various stakeholders on a wide range of sustainability issues. Comprehensive information about FAO policies and strategies as well as technical programmes and activities of the Organization can be accessed at the FAO web site address at (http://www.fao.org). FAO activities, information and publications relating to space applications, including remote sensing, GIS, agrometeorology, the environment, education and communications, can be found on the web site of the FAO Sustainable Development Department, SD-Dimensions (http://www.fao.org/sd) (environmental information/resources).

183. ESCAP will hold the annual meeting of the Regional Working Group on Satellite Communication Applications in Manila, the Philippines, in May 2000. The venue of the annual meeting in 2001 is to be determined.

184. ITU will organize WTPF to discuss and exchange views and information on broad telecommunication policy issues, technological advances, infrastructure development and financial business considerations. The second WTPF, which took place from 16 to 18 March 1998 in Geneva, was devoted to policy and regulatory issues raised by an agreement on trade in telecommunication services.

185. ITU organizes on a quadrennial basis the World Telecommunication Exhibition and Forum (TELECOM), in Geneva, as well as similar four-year rotational regional events in the Americas, Asia and Africa. World TELECOM-99 was the eighth TELECOM and took place at Geneva from 10 to 17 October 1999. The next World TELECOM will take place in Geneva in the year 2003. Problems related to the ever-increasing uses of outer space, such as communication satellites, remote sensing and navigational services, as well as direct satellite broadcasting to rural and underdeveloped areas of the world, are some of the main issues of concern and discussion at these forums.

4. Regulation of the use of the geostationary satellite orbit and the radio-frequency spectrum allocated to space communication services

186. ITU is making preparations for the world radiocommunication conferences (WRCs) in 2000 and 2003. The purpose of these conferences is to update the international radio regulatory process and prepare for future requirements. WRC-2000 will continue studying technical and regulatory aspects of communication using geostationary and non-geostationary satellites for various services, such as mobile satellites, Earth-exploration satellites, space research satellites, meteorological satellites and broadcasting satellites. An inter-conference representative group (IRG) is studying the feasibility of increasing the minimum channel capacity in the Broadcasting-Satellite Service Plan for countries in regions 1 and 3, to be submitted for consideration by the next WRC.

187. The Conference Preparatory Meeting (CPM), which has been established to carry out the necessary preparatory work for WRCs, will continue its work. ITU-R study groups are conducting studies in the field of space radiocommunications concerning technical aspects of mobile-satellite, fixed-satellite, Earth-exploration satellite, meteorological satellite, space research, space operation and broadcasting-satellite services and low-orbit satellite systems. The report to WRC-2000 was prepared by the CPM-97 in order to assist the ITU members who will be involved in the deliberations of WRC-2000. During the first meeting of CPM-99, the members of the study groups, working parties, task groups, joint rapporteur groups and joint task groups of ITU-R were entrusted with the responsibility of preparing the studies requested by WRC-97 ahead of the forthcoming WRC-2000 and WRC-2003. Joint Working Party 10-11S was given the task of studying, in cooperation with IRG, as a matter of urgency, the technical possibilities for increasing the minimum capacity assigned to all countries within regions 1 and 3 by the plans for regions 1 and 3, as contained in appendices 30 and 30A of the plans. The appropriate technical, operational and regulatory studies to review the regulatory provisions concerning the operation of non-geostationary fixed-satellite systems in the frequency bands covered by appendices 30 and 30A has been conducted by a joint task group of ITU-R study groups 4, 9 and 11.

188. Following the 1994 call by the ITU Plenipotentiary Conference, in its resolution 18, for a new in-depth review of the ITU spectrum/orbit resource allocation, WRC-97 decided to implement a number of aspects in order to increase efficiency and equity in spectrum/orbit utilization. The practical implementation of these measures and its results will be considered by WRC-2000.

189. The ITU Plenipotentiary Conference in 1998 considered the results of the review of the ITU spectrum/orbit resource allocation procedure. It adopted a number of resolutions relating to the development of improved radio regulatory procedures, recovery of costs for the processing of BR of satellite coordination requests and efficient conduct of WRCs.

5. Studies on and/or preparations for the establishment of new legal frameworks or the development of new systems to complement the existing legal frameworks

190. One of the decisions of the General Conference of UNESCO, at its twenty-eighth session, was to undertake studies at the regional level on the implications of electronic communication technologies, or "the information superhighways", for the protection and dissemination of intellectual works, in order to contribute to the consideration of the international standards which should govern the protection and circulation of intellectual works by electronic means. Following this decision, three regional committees, for the regions of Latin America, Asia and Europe, held meetings on the above-mentioned subject in order to assess the basic infrastructure of the various segments of the information superhighways, mainly the convergence of telecommunications, broadcasting, including satellite broadcasting, and electronic networks. In particular, the committees will have to define, for each region, the following:

(a) An outline of a national policy for the implementation of the basic infrastructure of transmission and digital dissemination of information, including the role of the State and the private operators, and the rules that must regulate the functioning of this infrastructure and the principles of interregional and international cooperation in this field;

(b) The main principles to follow in adapting national laws in order to ensure the protection of the legitimate rights of authors and of others in the digital multimedia context as well as to promote regional harmonization to secure cultural exchange;

(c) The strategy to be adopted by the States of the region and measures to be taken in order to promote the creation and development of cultural industries that will produce and disseminate products relating to digital works and performances as well as distance education. The Committees are also intended to help States to reach an international consensus for regulating the international circulation of data related to the exploitation of works and performances and to communication in general, within the framework of cyberspace.

191. The ICAO Panel of Legal and Technical Experts has elaborated a draft Charter on the Rights and Obligations of States Relating to GNSS Services, which embodies fundamental principles applicable to GNSS. It has also put forward 16 recommendations related to certification,

liability, administration, financing and cost recovery and future operating structures.

6. Land, maritime and aeronautical mobile satellite services

192. IMO is continuing its studies on a worldwide radio-navigation system and has adopted a revised policy for recognition and acceptance of such systems (IMO resolution A.815(19)). GPS and GLONASS, which had been offered by Governments as operational candidate systems, were evaluated, recognized and accepted in 1996. Amendments to the 1974 International Convention for the Safety of Life at Sea are being developed, taking into account the above-mentioned policy.

193. As the operational availability of GPS has been guaranteed by the United Sates only until 2005 and the operational availability of GLONASS has been guaranteed by the Russian Federation only until 2010, IMO is considering the need and seeking the means to develop plans for a post-GPS/GLONASS system, on the basis of internationally controlled civil GNSS in cooperation with ICAO and other user organizations. A maritime policy for a future civil and internationally controlled GNSS adopted in November 1997 (IMO resolution A.860(20)) is under review and will be finalized by November 2001. Furthermore, ICAO is developing provisions for ground and satellite-based augmentation systems for GPS/GLONASS to improve their overall availability, integrity and accuracy for aeronautical applications. Future work includes the development of ICAO standards for GNSS enhancements such as GPSL5, an additional civil frequency for GPS, and standards for aeronautical applications of Galileo.

194. ICAO and IMO are continuing cooperation for the multimodal use of GNSS in order to ensure that the service provided by the system will meet the needs of maritime users as well as the aviation community.

195. ICAO, recognizing the limitations of the present air navigation systems and the need to meet future requirements, has taken steps to promote the introduction of, *inter alia*, satellite-based technologies for communication, navigation and surveillance (CNS) elements in support of global air traffic management (ATM). The systems are an integration of terrestrial and space elements that will fulfil future international civil aviation requirements well into the present century. A fundamental prerequisite for the implementation of the systems on a global basis includes the development of uniform Standards and Recommended Practices (SARPs). Several panels of experts are involved in these activities under the responsibility of the ICAO Air Navigation Commission. With respect to space-related elements of the CNS/ATM systems, SARPs and guidance material have been completed for the aeronautical mobile-satellite service. Furthermore, acceptability criteria for aeronautical safety-related applications have been developed concerning the use of next generation satellite systems (NGSS), which utilize medium-Earth orbits (MEOs) and low-Earth orbits (LEOs) for the provision of mobile communications. SARPs for other elements including GNSS have been developed. SARPs for air traffic service applications including automatic dependent surveillance (ADS) systems and procedures, which are largely supported by satellite communications, are under development. Additional ADS provisions will be available in 2001. Provisions for the emergency locator transmitter, based on the International Search and Rescue Satellite System (COSPAS-SARSAT) programme have been reviewed, and amended SARPs are completed.

196. The planning and implementation of the CNS/ATM systems of ICAO are facilitated by a global plan and the activities of regional planning and implementation groups.

197. Within the framework of ITU-R Study Group 8 and the relevant study groups of ITU-R and ITU Telecommunication Development Sector, ITU is developing a series of standards for the development of IMT-2000, which is aimed at providing satellite and terrestrial mobile telecommunication services anywhere and at any time.

C. Meteorology and hydrology

1. Education and training programmes

Training courses, workshops and seminars

198. The Coastal Regions and Small Islands Unit (CSI of UNESCO will continue to organize regional training courses on the applications of remote sensing data to marine studies using BILKO image-processing software (Windows version), within the framework of the Training and Education in Marine Science programme. CSI will also:

(a) Continue to disseminate the seventh computer-based (BILKO for Windows) learning module "Applications of satellite and airborne image data to coastal management" to educational institutions in 2000;

(b) Publish a remote sensing handbook for tropical coastal management in 2000;

(c) Produce in 2001 a new module (BILKO for Windows) on the uses of multi-sensor, multi-temporal remote sensing data sets for monitoring dynamic coastal processes of erosion and accretion.

199. WMO plans to continue to collaborate with the United Nations, other organizations and WMO members in the co-sponsorship of training events during the biennium 2000-2001. The WMO proposals for satellite-related events for the biennium include a training course on tropical cyclones, to be held in Australia in 2000, with emphasis on small island developing States and the southern hemisphere, and two training workshops on hurricane forecasting and warning, to be held in the United States in 2000 and 2001. The programme of the postgraduate course in hydrology held annually in Kenya contains training in the use of satellite-based images and GIS in hydrology and water resource assessment. In the projects funded by the World Bank in the Mediterranean Sea basin, called Mediterranean Hydrological Cycle Observing System (MED-HYCOS), additional staff from participating countries will continue to be trained in the operation and management of DCPs using Meteosat for collecting hydrological, water-quality and related meteorological data. Within the framework of the project funded by the European Commission in SADC for the development of a regional hydrological information system (SADC-HYCOS), staff from the national hydrological services of SADC countries have been trained in the installation, operation and maintenance of DCPs for collecting hydrological, water-quality and related meteorological data. A second similar training course is planned for early 2000, also within the framework of the SADC-HYCOS project.

200. WMO grants fellowships under its Voluntary Cooperation Programme and its regular budget, as well as through UNDP and trust funds, for studies or training in meteorology, climatology and operational hydrology, including studies and training in satellite meteorology, interpretation of meteorological satellite photographs, satellite transmission systems and nephanalysis. In addition to fellows being trained at the WMO Regional Meteorological Training Centres (RMTCs), WMO members also provide training in numerical weather prediction products and interpretation of meteorological satellite data through fellowships offered by them under the Voluntary Cooperation Programme.

2. Expert services and survey missions to identify specific areas of applications relevant to a given country or group of countries and to carry out specific studies on pilot projects or to implement the projects with operational applications of technology

Provision of expert services and survey missions

201. UNEP, through GRID-Arendal, will continue to maintain a coastal environmental information system for the International Northern Sea Route Programme. Key institutions in Japan, Norway and the Russian Federation are linked to the project.

202. UNEP, through GRID-Arendal, is continuing to maintain the Baltic Sea catchment area database. The database can be accessed through the Internet and the World Wide Web.

Studies, pilot projects and operational applications

203. ICSU, UNEP, IOC of UNESCO and WMO continue to support the implementation of a global system for observing climate through their sponsorship of GCOS. GCOS is intended to be a longer-term, user-driven operational system capable of providing the comprehensive observations required for monitoring the climate system, for detecting and attributing climate change, for assessing the impact of climate variability and change, and for supporting research aimed at improving the understanding, modelling and prediction of the climate system. It addresses the total climate system, including physical, chemical and biological properties and atmospheric, oceanic, hydrologic, cryospheric and terrestrial processes.

204. GCOS has defined an Initial Operational System (IOS), which is being implemented under the direction of the GCOS Steering Committee and supported by the GCOS secretariat, which is located at the WMO Secretariat in Geneva. IOS is made up of the relevant components of existing or planned observational networks such as the WMO Global Observing System (GOS) and GAW and the climate components of GOOS and GTOS as well as the enhancements and new systems needed to meet the requirements for climate observations. Space-based observations form an integral and crucial part of IOS, and detailed needs of GCOS for such observations have been defined by the GCOS/GOOS/GTOS Global Observing Systems Space Panel (GOSSP), GCOS and GOSSP work

in close cooperation with CEOS in attempting to ensure that the necessary observations from space will be obtained. Further details on these activities can be found on the GCOS web site (http://www.wmo.ch/web/gcos/gcoshome.html).

205. ICSU, UNEP, IOC of UNESCO and WMO continue to cooperate closely in the development, planning and implementation of GOOS. IOC of UNESCO will continue to contribute to the work of CEOS concerning the development of user requirements for sensors and data management systems within the framework of the GOOS programme.

206. IOC of UNESCO, through the GOOS Coastal Panel and Living Marine Resources Panel, stresses the importance of ocean colour data, particularly the optimization of quality of data for validation, especially of coastal waters. The panels continue to advocate the collection of essential ocean and atmospheric data, data merging and access to data.

207. The application of satellite technology in meteorology, climatology and operational hydrology forms an important element of the technical cooperation activities of WMO. Those activities are generally undertaken with assistance from either the Voluntary Cooperation Programme of WMO or other sources of funding such as UNDP, the World Bank and the European Community. The following activities are planned for 2000 and future years:

(a) *Africa*: A number of WMO members, including France, Germany, Italy, the United Kingdom and the United States, are donating DCPs to countries in Africa for the collection of meteorological data via the geostationary meteorological satellite Meteosat to improve the availability of observational data at national meteorological centres. Furthermore, eight satellite stations of the International Mobile Satellite Organization (IMSO) were installed in the countries that are members of the Permanent Inter-State Committee on Drought Control in the Sahel with funding from USAID, in order to enhance the flow of data and products between the AGRHYMET regional centre at Niamey and national AGRHYMET centres. In collaboration with the World Bank, WMO has drawn up plans to set up in Africa an advanced hydrological and environmental monitoring system using Meteosat. More than 100 DCPs will be installed on major rivers, costing between $10 million and $20 million over a period of five years. Special efforts have been made to develop and submit proposals to the European Union to provide support for the replacement of ground receiving satellite equipment in all African countries by the year 2001 in order to adapt to the MSG satellite. Within the framework of MED-HYCOS, a project funded by the World Bank for the establishment of a hydrological information system for the Mediterranean basin, two Meteosat DCPs have been installed in Tunisia. One DCP is to be installed in Algeria as well as another two in Tunisia. These are part of a wider network of about 30 DCPs installed in several countries of the Mediterranean rim. A network of 50 Meteosat DCPs (of which 16 are already operational) is being installed in 11 SADC countries within the framework of the SADC-HYCOS project funded by the European Commission for the development of a hydrological information system in the region;

(b) *Americas*: The increasing demand in many developing countries of regions III and IV, South and North America, and the limited availability of experts in the major satellite-operating countries prompted WMO to develop a new training strategy known as "training the trainers". This strategy takes an innovative approach to both training and applied research in satellite data utilization and shows how an RMTC could develop considerable expertise in the utilization of, and training capability with, digital geostationary operational environmental satellite imagery by participating in a "virtual laboratory" with the Cooperative Institute for Research in the Atmosphere and Cooperative Institute for Meteorological Satellite Studies, both of NOAA. In addition to the above, through the ongoing project consisting of regional cooperation activities in support of the research on global change in the Inter-American Institute for Global Climate Change (IAI) countries, WMO provides training related to satellite image analysis and processing, using GIS, GIS-SPRING and Met-View software, to 15 countries of regions III and IV. CD-ROM Land Remote Sensing Satellite (LANDSAT) images have been bought for the project to enhance the capabilities of the participating countries to process and analyse such data, using modern techniques already provided for the project in previous training courses and seminars. The DCP ground equipment is being replaced with the support of the United States;

(c) *Europe and newly independent States*: Installation of small satellite Earth stations to provide meteorological services will be pursued and strengthened, in particular for newly independent States, for the reception of meteorological information distributed, via European Telecommunications Satellite Organization (EUTELSAT) satellites, by RETIM of France and FAX-E(urope) of Germany within the framework of regional meteorological

telecommunications. MED-HYCOS is currently installing in several countries of the region a network of 38 Meteosat DCPs (of which 12 are already operational). Real-time data can be freely accessed on the MED-HYCOS web site (http://www. medhycos.mpl.ird.fr);

(d) *Asia and Pacific*: Satellite-based telecommunications systems are playing an increasing role for the distribution of meteorological data and products to national meteorological services. The International Communication Satellite systems operated by the National Weather Service of the United States will be extended to serve countries in the South Pacific. A satellite-based communications system is being operated for distributing meteorological information within Asia, and it is likely to be expanded to other countries in the area of coverage of the Asiasat satellite. Inmarsat-M Earth Stations are also considered for improving communications of meteorological services in countries of the South Pacific. Additional systems have been installed in the South Pacific States, through the implementation of a European Union project to upgrade the tropical cyclone warning capabilities in cooperation with the Regional Association V (South-West Pacific), as well as in Oman and the United Arab Emirates.

208. The overall long-term goals of the World Climate Research Programme (WCRP), jointly sponsored by WMO, ICSU and IOC of UNESCO, are to determine to what extent climate can be predicted and the extent of human influence on climate. Progress in this scientific programme depends on the successful continuation or new development of space-based Earth observing systems. Key elements of WCRP with respect to the use of satellite data are as follows:

(a) The scientific plan for WCRP gives high priority to understanding the effects of cloudiness and precipitation on the radiation and energy budget. The International Satellite Cloud Climatology Project is producing long-term climatological records of global cloud amount and properties, as well as radiation flux data from the international array of geostationary meteorological satellites and operational polar-orbiting satellites. The Global Precipitation Climatology Project, also part of GEWEX of WCRP, is continuing to produce yearly global climatological records of precipitation based on satellite and *in situ* observations. Both projects will continue beyond the year 2000;

(b) Several major observational programmes are pursued by WCRP: after the completion of the final phase of the World Ocean Circulation Experiment (WOCE) in 1997, GEWEX, the Arctic Climate System Study (ACSYS) and the "Climate variability and predictability" (CLIVAR) study all use operational meteorological satellites, the altimeters on Topex/Poseidon and ERS-2 and their follow-on sensors, as well as the new series of Earth observation satellites, to be launched in 1999 and 2000.

209. Climate system monitoring activities within the World Climate Data and Monitoring Programme make use of satellite data for monitoring such parameters as sea level, atmospheric temperature, sea ice, snow cover, solar radiation, aerosol optical depth, albedo and clouds. The WMO World Climate Data Information Referral System (INFOCLIMA) includes information on some available satellite data sets needed for climate monitoring and research. A Climate Change Detection Project has been established under the World Climate Data and Monitoring Programme to advise on the suitability of data, including satellite data, for detecting climate change. The World Climate Applications and Services Programme continues to investigate and promote development of potential uses of satellite data in climate applications, especially within the framework of the Climate Information and Prediction Services (CLIPS) project.

210. WMO continues to provide valuable data and assessments concerning atmospheric status under the Atmospheric Research and Environment Programme through GAW, which it established in 1989 as a long-term monitoring and research system to detect changes in the composition of the atmosphere at global and regional scales. Work includes monitoring and research on pollutants, acid deposition and greenhouse gases, including ozone, aerosols and other trace substances in the atmosphere that may lead to global climate change. GAW data include surface and vertical observations, which provide information required to verify satellite-based measurements of selected atmospheric constituents. In particular, GAW, through its more than 150 total ozone monitoring stations, has furnished critical ground truth data to calibrate ozone observations from space. These satellite observations, in turn, provide vital information used in the preparation of near-real-time ozone bulletins on the state of the ozone layer during both the Antarctic austral spring and the northern hemisphere winter. In addition, using four-dimensional variational assimilation techniques, major global numerical weather forecasting centres are starting to assimilate real-time ozone observations from satellites as well as ground-based measurements in order to improve the analysis of stratospheric winds and ozone radiative effects.

211. The WMO Commission for Atmospheric Sciences continues to rely on the use of satellite data for research, and for weather analysis and prediction on all time scales. The WMO programmes on weather prediction and tropical meteorology research continue to study the application of high-resolution quantitative satellite data. The newly established World Research programme focusing on high impact weather with major socio-economic consequences has a strong nowcasting component that relies heavily on real-time satellite imagery.

212. Major WMO global data-processing centres operated by WMO members within the framework of the World Weather Watch and equipped with supercomputers and high-end mainframe computing facilities depend on remotely sensed data from meteorological satellites for operational input data, particularly in ocean and land areas for which data are otherwise sparse. Data acquired by meteorological satellites are used in global atmospheric and ocean models for numerical weather prediction and environmental quality assessment, as well as climate monitoring and medium-range, long-range, seasonal and multi-seasonal weather and climate prediction.

213. As a part of its scientific activities, the WMO Commission for Hydrology has appointed an expert on remote sensing applications in hydrology to evaluate advances in and the application of remote sensing in hydrology, as well as the national capabilities in developing countries to make use of these technologies. The application of satellite-based observation technologies is also addressed by the experts on network design and water quantity data, as well as by the Working Groups on Hydrology of the six WMO regional associations. The results of the activities of the Commission's experts and of the Working Groups will be available in 2000.

214. The World Hydrological Cycle Observing System (WHYCOS) is a global programme launched by WMO aimed at strengthening hydrological information systems and further promoting international cooperation to enhance sustainable socio-economic development. WHYCOS is implemented through regional or basin-wide HYCOS components.

215. Within the framework of the programme, a number of HYCOS components are already being implemented or are planned. A key element of many of these projects is the rehabilitation and upgrading of the local hydrological observation networks through the installation of a network of automatic satellite-linked data collection platforms. Through the WMO Global Telecommunications System (GTS) and other global networks such as the Internet, the data collected are made available in near-real-time to water resource planners, decision makers, scientists and the general public.

216. Within the framework of the two ongoing projects, MED-HYCOS for the Mediterranean rim and SADC-HYCOS for southern Africa, networks of 38 and 50 Meteosat DCPs, respectively, are being installed. The West and Central African Hydrological Cycle Observing System (AOC-HYCOS) started a pilot phase in November 1999. Similar developments are expected during the coming years in other regions, such as eastern Africa, the Caribbean, the south-western Pacific, and the Baltic and Black Sea basins as soon as the relevant HYCOS components, presently being developed, are funded and launched.

217. WMO, in cooperation with IMO and IOC of UNESCO, maintains and continues to upgrade the internationally coordinated agreements, procedures, protocols and facilities, especially software, for the dissemination of meteorological and oceanographic data and information to ships at sea, and for the collection of data from those ships, using the IMSO maritime satellite system, in particular the Inmarsat-C facility. The WMO marine broadcast system, which is globally coordinated under the Global Maritime Distress and Safety System (GMDSS), became fully operational in 1999.

218. The Data Buoy Cooperation Panel (DBCP), a joint undertaking of WMO, IOC of UNESCO and all data buoy operators, is making constant use of the "ARGOS" system (which flies on board the NOAA operational satellites) for data collection and platform location. This system will also be used to serve the forthcoming ARGOS project that deals with subsurface floats.

219. With support from the WMO World Weather Watch, the WMO Commission for Aeronautical Meteorology, in collaboration with ICAO, is actively involved in the implementation of the World Area Forecast System (WAFS), which uses satellite-based communication systems to distribute information on aeronautical meteorological forecasts in support of commercial aviation (as part of the ICAO aeronautical fixed service). The London World Area Forecast Centre (WAFC) transmits WAFS products via the Satellite Distribution System for Information related to Air Navigation to Africa, Europe and west Asia, and the Washington WAFC transmits, using two satellites, to the rest of the world.

220. The main FAO activities on agro-climatic databases and agro-meteorology, using data from both satellite and *in situ* observations, and using GIS tools, include: (a) management of the climatic database for about 25,000 stations worldwide called "FAOCLIM"; (b) production of digital maps (at various levels) based on the climatic database; (c) compilation of a database of African subnational crop statistics; (d) real-time monitoring of food crop conditions and yield forecasting, in particular for African countries; and (e) fulfilment of specific requests that require the analysis of climatic data integrated with socio-economic variables. ARTEMIS and an agrometeorology programme called "AGROMET" are providing essential value-added analysis and related information products for the FAO operational GIEWS on food and agriculture. Since September 1999, FAO ARTEMIS and agro-meteorological climatological databases have been accessible through a common Internet web site (http://metart.fao.org).

3. Dissemination or exchange of information on the status of technology or operational systems through meetings or publications

Dissemination of technological information

221. UNEP, through DEIA&EW/GRID-Bangkok, continues to work on the following collaborative undertakings:

(a) Coastal and Marine Environmental Management Information System for the South China Sea area, covering Cambodia, southern China and Viet Nam;

(b) Further development of the North West Pacific Action Plan of the UNEP Regional Seas Programme.

222. The ESCAP Regional Working Group on Meteorological Satellite Applications and Natural Hazards Monitoring will continue to update its homepage on the Internet.

223. Within the framework of the International Hydrological Programme (IHP), UNESCO is cooperating with the International Association of Hydrological Sciences in the organization of the Third HydroGIS Conference, which will be held in Vienna, Austria, in 2001. The Conference will disseminate new experiences and information on the uses of GIS in hydrology and water resources development.

224. WMO issues a biennial report on the status of implementation of the World Weather Watch. The report includes a section on the space-based portion of the Global Observing System, consisting of a network of geostationary and polar-orbiting satellites. The next report will be published in mid-2000. The status of satellite technology for application in meteorological observations and telecommunications is considered at each session of the WMO Commission for Basic Systems, which meets on a biennial basis. The next session of the Commission will take place during the second half of 2000.

225. The Joint Technical Commission for Oceanography and Marine Meteorology of WMO and IOC of UNESCO maintains a high level of interest in the use of satellites for ocean remote sensing and the provision of marine services based on satellite data. A rapporteur reports to the Commission and WMO members on issues relating to requirements for, access to and applications of remotely sensed ocean data. The rapporteur also liaises with the WMO Commission for Basic Systems and with GOSSP of the Global Observing Systems (GCOS, GOOS, GTOS). The rapporteur prepares regular reports for the Commission.

226. The WMO World Climate Programme publishes on a regular basis information on the Global Climate System within the framework of projects such as the Climate System Monitoring and CLIPS. The information is, to a large extent, based on data received from space-based observation platforms.

227. A working group of the WMO Commission for Agricultural Meteorology is currently responsible for reviewing and summarizing the development of techniques and methods to obtain and manage ground-based and remotely sensed agrometeorological and agronomic data in the most timely and efficient manner for applications to agriculture.

Elaboration of strategies or plans for future applications programmes or systems and/or policy coordination

228. UNEP, FAO, IOC of UNESCO, WMO and ICSU cooperate in the Sponsors Group for the Global Observing Systems (GCOS, GOOS and GTOS), or G3OS, with the objective of providing advice and making recommendations to the sponsoring organizations and their governing bodies, the Observing System steering committees, secretariats and expert panels, as well as possibly other groups, including funding bodies and Governments. In this context, those organizations particularly contribute to the activities of GOSSP.

229. A number of partners, including CEOS members and associate members such as FAO, ICSU, IOC of UNESCO,

UNEP, WMO and IGF, have been working together closely since 1998 on the development of IGOS in an effort to optimize space-based and *in situ* observing networks and application programmes at the global, regional and national levels. In July 1999, IGOS was presented at the UNISPACE III Conference through a one-day high-level forum, which was coordinated by FAO. Conclusions and proposals of the International Forum on the Integrated Global Observing Strategy are contained in the report of UNISPACE III (A/CONF.184/6, annex III, section IV). IGOS is vigorously developing an integrated theme approach. The themes "Ocean", "Terrestrial carbon observations" (TCO) and "Disaster management" have been endorsed by the IGO partnership: the themes are to be coordinated by NASA, GTOS/FAO and NOAA, respectively.

230. The GCOS secretariat, jointly established by UNEP, WMO, IOC of UNESCO and ICSU, reports frequently on the GCOS Steering Committee, experts and panel meetings. Revised and updated space observation and terrestrial observation plans, including recommendations and the list of user requirements, are available from the GCOS secretariat. Newsletters to initiate and foster the exchange of ideas and information are provided by the secretariat on a regular basis and are available, together with all other publications, on the Internet link (http://www.wmo.ch/web.gcos/home.html).

231. ESCAP will hold the annual meeting of the Regional Working Group on Meteorological Satellite Applications and Natural Hazards Monitoring at Seoul, Republic of Korea, in June 2000. The venue of the annual meeting in 2001 is to be determined.

232. Cooperation with other agencies is a major focus of FAO participation in climate-related activities. FAO is an active member of the Inter-Agency Committee on the Climate Agenda (IACCA) and cooperates on climate-change matters with international bodies such as the United Nations Framework Convention on Climate Change secretariat and the Intergovernmental Panel on Climate Change (IPCC).

D. Basic space science

233. The Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, will co-sponsor the participation of scientists from developing countries in the thirty-third Scientific Assembly of the Committee on Space Research, particularly in the Workshop on the Integrated Global Observing Strategy—Role and Benefits to Developing Countries, to be held at Warsaw, Poland, from 16 to 23 July 2000.

234. The United Nations Programme on Space Applications is organizing the Ninth United Nations/European Space Agency Workshop on Basic Space Science: Satellites and Network of Telescopes—Tools for Global Participation in the Studies of the Universe, to be held in Toulouse, France, from 27 to 30 June 2000.

235. The United Nations Programme on Space Applications is planning the Tenth United Nations/European Space Agency Workshop on Basic Space Science, to be held in 2001 in Reduit, Mauritius.

236. In 2000 and beyond, the Office for Outer Space Affairs, within the framework of the United Nations Programme on Space Applications, will continue its collaboration with ESA in carrying out follow-up activities relating to the series of workshops on basic space science organized during the period 1991-1999. These activities include the establishment of telescope facilities in Morocco, Paraguay, Peru and the Philippines. The Office is also supported in this effort by the Government of Japan.

237. The ESCAP Regional Working Group on Space Sciences and Technology Applications will continue to update its homepage on the Internet.

238. ESCAP will hold the annual meeting of the Regional Working Group on Space Sciences and Technology Applications in Canberra, Australia, in May 2000. The venue of the annual meeting in 2001 is to be determined.

E. Safety and disaster reduction

239. The IDNDR programme came to an end in December 1999. The achievements of the Decade and the implementation of Economic and Social Council resolution 1999/63 on the successor arrangements to IDNDR are documented in two reports of the Secretary-General (A/54/132 and A/54/497). Starting January 2000, the new International Strategy for Disaster Reduction will succeed the IDNDR programme; its overarching objective is to proceed from protection against hazards to the management of risk through the integration of risk prevention into sustainable development. With this aim in mind, an inter-agency task force for disaster reduction will be established, together with an International Strategy for Disaster

Reduction secretariat, which will coordinate the implementation of the United Nations-ISDR programme, derived from the strategy "A Safer World for the Twenty-first Century", adopted in July 1999 by the IDNDR Programme Forum.

240. The International Strategy for Disaster Reduction secretariat will continue to give high visibility to aspects relating to the use of space technology for disaster prevention and the reduction of vulnerability, in line with the engagement of IDNDR in this rapidly developing field. Two specific fields come under consideration in this context: satellite techniques for telecommunications; and Earth-observation techniques. Concerning the use of satellite techniques for telecommunications and early warning, the IDNDR programme forum discussed an "Early warning action plan for the future", which highlighted that the target of early warning for disaster reduction is to empower individuals and communities threatened by natural and similar hazards to act in sufficient time and in an appropriate manner so as to reduce the possibility of personal injury, loss of life and damage to property or fragile environments. The measures recommended in the action plan will be pursued by the International Strategy for Disaster Reduction in collaboration with partner agencies from within and outside the United Nations system in 2000 and 2001.

241. With reference to the use of remote sensing, Earth-observation and other satellite-based techniques for reducing the impact of natural and similar disasters, ISDR will concentrate on international partnerships to contribute to the definition of user requirements, so as to increase the effectiveness of satellite techniques in countering the adverse effects of natural hazards. In doing so, the ISDR secretariat will continue to work in those areas identified in the IDNDR programme, such as IGOS and others, while developing new avenues for partnership among international institutions and the private sector. Renewed attention will also be given to programmes involving civil society, such as training programmes. A specific seminar on the use of remote sensing for disaster reduction is currently planned for the biennium 2000-2001.

242. In 2000 and beyond, the United Nations Programme on Space Applications will organize workshops aimed at developing pilot projects to incorporate the use of space technologies in disaster management actions of civil protection and emergency response agencies in developing countries. The Programme will coordinate these activities with diverse ongoing international efforts, such as those by CEOS and the new ISDR, and will invite relevant national and international institutions and organizations to participate in planning and implementing the activities.

243. ESCAP is currently developing a proposal to hold a regional seminar on the use and potential of space technology and its applications for monitoring and alleviating natural disasters in 2000.

244. ESCAP will develop pilot projects on the applications of space technology for natural disaster monitoring and mitigation at the national and regional levels, following the recommendations of the planned regional seminar on the use and potential of space technology and its applications for monitoring and alleviating natural disasters.

245. Starting in 1998-1999, when forest fires and wildfires broke out at locations around the world, UNEP/GRID-Geneva prepared a web site, which is regularly updated, linking relevant information from existing sources on the World Wide Web such as ESA, NASA, NOAA and national meteorological agencies. The aim of the project has been to summarize and disseminate available information on wildfires worldwide. The web site provides a weekly report and includes maps and images downloaded from World Wide Web, which are in some cases further refined or produced by GRID-Geneva. New pages for "links to related sites" and for downloading the report "Wildland Fires and the Environment: a Global Synthesis" have been added in order to ensure a more rapid dissemination of products to users. At the same time and for many months, status reports on the fires were provided to the Office for Coordination of Humanitarian Affairs in Geneva. These activities will continue in 2000, as there is a clear need for such information and the number of visits to the web site has continued to increase since early 1999.

246. A new project for collaboration between UNEP/GRID-Geneva and SDRN of FAO has been developed on the topic of "Use of GIS and Terra-Modis data for forest and wildfires' detection, mapping and monitoring". The goal of this activity is to achieve a better understanding of the human and physical conditions leading to the outbreak and presence of fires, and to provide information about the impact on biodiversity. The project is to be initiated jointly by GRID-Geneva and FAO/SDRN during early 2000.

247. The amendments to the 1974 International Convention for the Safety of Life at Sea (SOLAS) that were adopted by the 1988 Conference of Contracting Governments entered into force on 1 February 1992,

introducing GMDSS. The system was introduced in stages, and its requirements have been mandatory for SOLAS ships since 1 February 1999. Satellite communications form a major part of GMDSS, and all SOLAS ships are requested to carry a satellite emergency position-indicating radio beacon (EPIRB). IMO also continues to prepare the master plan of shore-based facilities for GMDSS and provides technical assistance on this matter to developing countries.

248. The further development and implementation of GMDSS to provide for its use on all ships will be continued by IMO in close cooperation with ITU, IMSO and the International Satellite Systems for Search and Rescue (COSPAS-SARSAT).

249. UNESCO cooperates with the Council of Europe, within the framework of the Council of Europe Open Partial Agreement on the Prevention of, Protection against and Organization of Relief in Major Natural and Technological Disasters, in carrying out research studies on the use of space technology in disaster management.

250. UNESCO, in cooperation with the European Association of Remote Sensing Laboratories (EARSeL) and the STRIM programme of the Council of Europe, will organize an international symposium on "Space techniques for the management of major risks and their consequences" in Paris from 5 to 7 April 2000.

251. The ITU/BDT, with the participation of ITU Member States, has elaborated during 1994 to 1999, National Master Plans for the Development of Maritime Radiocommunication Services, including the implementation of GMDSS, for the benefit of the countries of the African, Arab and Caribbean regions. During 2000-2001, a regional plan for coordination and cooperation on safety and security at sea using GMDSS will be developed based on these National Master Plans.

252. The ITU-R Study Group 8 (mobile, radio determination, amateur and related satellite services) continues to examine various aspects of satellite uses in GMDSS, including the characteristics of EPIRB systems, and studies on technical and operational characteristics of satellite systems participating in GMDSS and GNSS.

253. ITU-R will continue to study those aspects of radiocommunications that are relevant to disaster mitigation and relief operations, such as decentralized means of communications that are appropriate and generally available, including amateur radio facilities and mobile and portable satellite terminals. ITU will work closely with the Emergency Relief Coordinator with a view to further increasing ITU involvement in, and support to, disaster communications. The Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations, prepared in cooperation by ITU, the Department of Humanitarian Affairs of the Secretariat, the secretariat of IDNDR and the International Committee of the Red Cross, was adopted by the Intergovernmental Conference on Emergency Telecommunications, held in Tampere, Finland, from 16 to 18 June 1998. The aim of the Convention is to overcome various limitations and barriers experienced in disaster communications. The 1998 meeting of the Plenipotentiary Conference of ITU, which adopted the five-year Strategic Plan of ITU, urged States to work towards the earliest possible ratification, acceptance, approval or signature of the Convention and to take all practical steps for its application.

254. The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, at its thirty-seventh session, in 2000, will begin its four-year work plan on the use of nuclear power sources in outer space. The Subcommittee in 2000 will identify terrestrial processes and technical standards that may be relevant to nuclear power sources, including factors that distinguish nuclear power sources in outer space from terrestrial nuclear applications. In accordance with a recommendation of the Scientific and Technical Subcommittee, the Office for Outer Space Affairs has invited Member States and international organizations, in particular the International Atomic Energy Agency (IAEA), to submit relevant information. At its thirty-eighth session in 2001, the Subcommittee will review national and international processes, proposals and standards and national working papers relevant to the launch and peaceful use of nuclear power sources in outer space.

255. Appropriate consideration should be given in the Scientific and Technical Subcommittee and the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space to international conventions on nuclear safety and on early notification and assistance in emergency situations, as well as internationally endorsed safety standards published by IAEA.

F. Other activities

256. The United Nations Programme on Space Applications continues to make progress in establishing regional centres for space science and technology education, affi-

liated with the United Nations, in developing countries. The centres are expected to enhance the academic and professional capabilities and technical infrastructure in space science and technology in each region. A number of workshops at the regional centres are planned to be organized by the United Nations Programme on Space Applications in 2000 and 2001. The following activities will be conducted in 2000 and beyond:

(a) The Programme will continue to provide technical advisory assistance to the regional Centre for Space Science and Technology Education in Asia and the Pacific, which was inaugurated in India in 1995, in developing and organizing educational and training programmes in various fields of space applications;

(b) The Programme will provide technical advisory assistance to the Governments of Brazil and Mexico, which have announced the inauguration of the regional Centre for Space Science and Technology Education in Latin America and the Caribbean in 2000, and will assist in coordinating education and training activities of the Centre;

(c) The Programme will provide technical assistance to the two regional centres for space science and technology education in Africa, one in the French language in Morocco and one in the English language in Nigeria, which were inaugurated in 1998, in developing and organizing long-term educational and training programmes in various fields of space applications. The Centre in Morocco is expected to start its first two education programmes, one in remote sensing and GIS and the other in telecommunications, in 2000. The Centre in Nigeria is also expected to start an education programme on remote sensing in 2000;

(d) The Programme is providing assistance to the Government of Jordan for the establishment of a regional centre in western Asia. The centre is expected to be inaugurated in 2001;

(e) The Programme will provide technical assistance in support of the Network of Space Science and Technology Education and Research Institutions for Central-eastern and South-eastern Europe, which involves Bulgaria, Greece, Hungary, Poland, Romania, Slovakia and Turkey.

257. Workshops on remote sensing applications for sustainable development programmes and disaster management activities are planned to be organized by the United Nations Programme on Space Applications in cooperation with the regional centres in Africa, Asia and the Pacific, and Latin America and the Caribbean in 2000.

258. The United Nations Industrial Development Organization (UNIDO), in cooperation with the Office for Outer Space Affairs, has developed a pilot project on utilizing distance learning to build and strengthen the capacity for investment and technology promotion in developing countries. A preparatory meeting to build consensus on distance learning methodologies and select thematic subjects among the partners is planned to be held in September 2000 in Malaysia. The main objective of the pilot project, which will be completed in 2001, is to develop a wider UNIDO programme to broaden the application of modern information and communication technologies for distance learning in the capacity-building programmes of its Service Modules.

259. Pursuant to General Assembly resolution 54/68 of 6 December 1999, the Office for Outer Space Affairs, in collaboration with Member States, organizations within the United Nations system and space-related intergovernmental and non-governmental organizations and industry, will in the coming years implement the recommendations of UNISPACE III, held from 19 to 30 July 1999 in Vienna. The Office plans to submit to the forty-third session of the Committee on the Peaceful Uses of Outer Space, to be held at Vienna from 7 to 16 June 2000, its proposals on the implementation of follow-up actions of UNISPACE III, including the following: (a) organization of a one-day industry symposium during the annual session of the Scientific and Technical Subcommittee; (b) identification and promotion of the use of appropriate space technologies to meet the needs of programmes and organizations within the United Nations system in carrying out their activities that have not yet benefited from the use of space technology; (c) organization of an annual public forum to inform the general public of past, ongoing and planned space activities and the future direction of such activities; (d) organization of activities for youth; and (e) establishment of a programme of visits by astronauts, cosmonauts and other space scientists and engineers to increase knowledge about space-related activities, in particular among young people.

260. The General Assembly, in its resolution 54/68, endorsed the resolution of UNISPACE III entitled "The Space Millennium: Vienna Declaration on Space and Human Development" (A/CONF.184/6, chap. I, resolution 1) which is the nucleus of a strategy to address global challenges such as: protecting the Earth's environment and

managing its resources; using space applications for human security, development and welfare; advancing scientific knowledge of space and protecting the space environment; and enhancing education and training opportunities and ensuring public awareness of the importance of space activities. The Assembly urged organizations within the United Nations system to take the necessary action for the effective implementation of the Vienna Declaration. The Assembly also requested all relevant organizations of the United Nations system to review and, where necessary, adjust their programmes and activities in line with the recommendation of UNISPACE III and to take appropriate measures to ensure their full and effective implementation, in particular by further enhancing the coordination of their space-related activities through the Inter-Agency Meeting on Outer Space Activities. The Assembly also invited relevant governing bodies of the organizations within the United Nations system responsible for space-related activities to establish an ad hoc intergovernmental advisory group to review inter-agency coordination of space-related activities with a view to increasing the effectiveness of the work of the Inter-Agency Meeting on Outer Space Activities.

261. The General Assembly, in its resolution 54/68, further declared "World Space Week" from 4 to 10 October to celebrate each year at the international level the contributions of space science and technology to the betterment of the human condition. The Assembly also decided to review and appraise, at its fifty-ninth session, in 2004, the implementation of the outcome of UNISPACE III and to consider further actions and initiatives.

262. The Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space adopted in 1999 its Technical Report on Space Debris (A/AC.105/720) and will continue to discuss the issue of space debris on a priority basis. In this context, the thirty-seventh session of the Subcommittee, to be held at Vienna from 7 to 18 February 2000, will review international application of ITU standards and Inter-Agency Space Debris Coordination Committee (IADC) recommendations concerning the disposal of satellites in geosynchronous orbit at the end of their useful life.

263. The Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space, at its thirty-ninth session in 2000, will introduce in its agenda item entitled "Information on the activities of international organizations relating to space law". The Office for Outer Space Affairs has invited international organizations to submit relevant information.

264. The United Nations Programme on Space Applications is planning the following activities in the period 2000-2001:

(a) United Nations/Austria Symposium on Space Technology and Development, to be held in Graz, Austria, in 2000;

(b) United Nations/International Astronautical Federation Workshop on Operational Strategy for Sustainable Development using Space, to be held in Rio de Janeiro, Brazil, from 28 September to 1 October 2000;

(c) United Nations/European Space Agency/Committee on Space Research Workshop on Data Analysis Techniques, to be held in Bangalore, India in May 2000;

(d) United Nations/Austria Symposium on the Use of Space Technology for Development, to be held in Graz, Austria, in 2001;

(e) United Nations/International Astronautical Federation Workshop on Space Technology for the Benefit of Developing Countries, to be held in Toulouse, France, in 2001.

265. The Office for Outer Space Affairs, in the period 2000-2001, will continue to provide technical advisory assistance to the Government of Uruguay in its follow-up, as *pro tempore* secretariat, of the recommendations of the Third Space Conference of the Americas, held in Punta del Este, Uruguay, in November 1996, in particular the implementation of the plan of action adopted at the Conference.

266. Since 1989, the United Nations Programme on Space Applications has published an annual collection of papers selected from among those presented at the meetings, workshops and training courses organized under its auspices. The publication, entitled *Seminars of the United Nations Programme on Space Applications*, covers different aspects of space science and technology. It includes papers that are broad in scope and of enduring interest. The eleventh edition, which contains manuscripts presented at meetings organized in 1999, will be issued in early 2000.

267. In order to keep the member States and the general public informed of the latest developments in activities carried out by the United Nations Programme on Space Applications, the homepage of the Programme was established on the Internet within the web site of the Office for Outer Space Affairs. The homepage, which is accessible

through the World Wide Web (http://www.un.or.at/oosa/) contains information on activities that have been implemented, as well as reports and press releases issued within the framework of the Programme. The schedules, objectives and programmes of planned activities are also included in the homepage.

268. As follow-up activities to the Second Ministerial Conference on Space Technology Applications for Sustainable Development, ESCAP plans to hold the following regional meetings:

(a) The ad hoc expert group meeting on the Minimum Common Programme of space technology applications, in March 2000;

(b) The regional seminar on the development of space technology applications for the second phase of the Regional Space Applications Programme (RESAP II), in March 2000;

(c) The Sixth Session of the Intergovernmental Consultative Committee on the Regional Space Applications Programme for Sustainable Development, in July 2000, and the Seventh Session in 2001;

(d) The Sixth Meeting of the Regional Inter-agency Committee for Asia and the Pacific (RICAP) Subcommittee on Space Applications for Sustainable Development, in July 2000, and the Seventh Meeting in 2001;

(e) The Third Meeting of the Dialogue Forum on harmonization of regional space initiatives on space technology applications, in 2000, and the Fourth Meeting in 2001.

269. ESCAP will prepare and disseminate the following publications:

(a) The Proceedings of the Second Ministerial Conference and other meetings, seminars and workshops organized by ESCAP;

(b) The quarterly *Space Applications Newsletter*.

270. ESCAP will continue to update its homepage on Space Technology Applications for Sustainable Development on the Internet.

271. The Office for Outer Space Affairs will continue to maintain, on behalf of the Secretary-General, the United Nations public register of information furnished in accordance with article IV of the Convention on Registration of Objects Launched into Outer Space (General Assembly resolution 3235 (XXIX), annex) and to disseminate such information to Member States.

272. Within the framework of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST, UNESCO and ESA have set up a Working Group on the Ethics of Outer Space in order to prepare a report on ethical issues raised by outer space activities. The themes on which the report will be based are: man in space, development of space science and technology, use of space technologies, space and protection of the environment, and protection of individual liberty and cultural identity. The report of the Working Group will be available in early 2000 and a subcommission of COMEST will be set up to draw up ethical guidelines which will be examined by the COMEST during its second session in 2001.